APPENDIX TO THE REPORT OF THE MINISTER OF AGRICULTURE

EXPERIMENTAL FARMS

REPORTS

OF THE

DIRECTOR	WM. SAUNDERS, C.M.G., LL.D.
DOMINION AGRICULTURIST	J. H. GRISDALE, B. AGR.
" HORTICULTURIST	W. T. MACOUN
" CEREALIST	C. E. SAUNDERS, PH.D.
" CHEMIST	FRANK T. SHUTT, M.A.
" ENTOMOLOGIST	C. GORDON HEWITT, D.Sc.
" BOTANIST	H. T. GÜSSOW
POULTRY MANAGER	A. G. GILBERT
SUPT. EXPERIMENTAL FARM, NAPPAN, N.S.	R. ROBERTSON
" " " CHARLOTTETOWN, P.E.I.	J. A. CLARK, B.S.A.
" " " BRANDON, MAN.	JAMES MURRAY, B.S.A.
" " " INDIAN HEAD, SASK.	ANGUS MACKAY
" " " ROSTHERN, SASK.	WM. A. MUNRO, B.A., B.S.A.
" " " LETHBRIDGE, ALTA.	W. H. FAIRFIELD, M.S.
" " " LACOMBE, ALTA.	G. H. HUTTON, B.S.A.
" " " AGASSIZ, B.C.	THOS. A. SHARPE

FOR THE

YEAR ENDING MARCH 31

1910

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APPENDIX

TO THE

REPORT OF THE MINISTER OF AGRICULTURE

ON

EXPERIMENTAL FARMS

OTTAWA, March 31, 1910.

SIR,—I beg to submit for your approval the twenty-third annual report of the work done and in progress at the several Experimental Farms.

In addition to my own report, you will find appended, reports from the following Dominion officers of the Central Experimental Farm:—From the Agriculturist, Mr. J. H. Grisdale; from the Horticulturist, Mr. W. T. Macoun; from the Cerealist, Dr. C. E. Saunders; from the Chemist, Mr. Frank T. Shutt; from the Entomologist, Dr. C. Gordon Hewitt; from the Botanist, Mr. H. T. Güssow; and also from the Poultry Manager, Mr. A. G. Gilbert.

From the Branch Experimental Farms there are reports from Mr. R. Robertson, Superintendent of the Experimental Farm for the Maritime Provinces, at Nappan, Nova Scotia; from Mr. J. A. Clark, Superintendent of the Experimental Farm for Prince Edward Island at Charlottetown; from Mr. James Murray, Superintendent of the Experimental Farm for Manitoba at Brandon; from Mr. Angus Mackay, Superintendent of the Experimental Farm for Southern Saskatchewan at Indian Head; from Mr. Wm. A. Munro, Superintendent of the Experimental Farm for Central Saskatchewan at Rosthern; from Mr. W. H. Fairfield, Superintendent of the Experimental Farm for Southern Alberta at Lethbridge; from Mr. G. H. Hutton, Superintendent of the Experimental Farm for Central Alberta at Lacombe, and from Mr. Thomas A. Sharpe, Superintendent of the Experimental Farm for British Columbia at Agassiz.

In these reports there will be found the results of many importaut and carefully conducted experiments in agriculture, horticulture and arboriculture, the outcome of practical and scientific work in the fields, barns, dairy and poultry buildings, orchards and plantations at the several Experimental Farms; of scientific research iu connection with the breeding of cereals and in determining their relative value; of research

work in the chemical laboratories bearing on many branches of agricultural and horticultural employment; of careful study of the life-histories and habits of injurious and beneficial insects and the best methods to adopt for destroying the most injurious species. In the report of the work of the Entomological Division will also be found particulars of the experiments and observations which have been made during the past year in connection with the apiary. Continued attention has been given to the subject of noxious weeds and the most practical and economical methods by which they may be destroyed; attention has also been given to research into the diseases of plants, the circumstances under which they are propagated and the most effective measures for their subjugation.

The large and constantly increasing demand by the farmers of the Dominion for the publications issued from the Experimental Farms, the rapidly extending correspondence, and the readiness shown by farmers everywhere to co-operate with the work of the farms in the testing of new and promising varieties of cereals and other farm crops, furnish gratifying evidence of the desire for information among this class of the community, also of the high esteem in which the work of the farms is held. It is hoped that the facts brought together in the present issue will be found of much practical value to the Canadian farmer and fruit-grower, and that they may assist in advancing agriculture and horticulture in this country.

I have the honour to be, sir,

Your obedient servant,

WM. SAUNDERS,

Director, Dominion Experimental Farms.

To the Honourable

The Minister of Agriculture,

Ottawa.

ANNUAL REPORT OF THE EXPERIMENTAL FARMS

For the year ending March 31, 1910

REPORT OF THE DIRECTOR

WM. SAUNDERS, C.M.G., LL.D., F.R.S.C., F.L.S.

The season of 1909, although generally late in opening, which delayed seeding, was, during the later growing months, quite favourable, and resulted in most localities in satisfactory crops. Had early sowing been practicable, the average yields would, no doubt, have been larger. In the Census and Statistics Monthly, issued by the Department of Agriculture, from which most of the following figures were obtained, the field crops of the Dominion are given as covering a total area of 30,065,556 acres and as yielding crops which, estimated at average local market prices, would reach the value of $532,992,100, an increase in the total value above that of last year of over $100,000,000.

In Ontario, the spring weather of 1909, like that of 1908, was unusually wet, and on this account seeding was much delayed. The rainfall of March, April and May was several inches more than the average of many years past. Later in the season, the weather was much more favourable and the resulting crops of grain gave a higher yield per acre than in 1908. The crop of winter wheat is given as 14,086,000 bushels, the average yield being 24·24 bushels per acre. Spring wheat gave an average of 17·45 bushels per acre, the total crop being 2,176,000 bushels. The total crop of oats was 109,192,000 bushels with an average yield of 34·75 bushels per acre. The barley, the total crop of which was 20,952,000 bushels, gave an average of 29·04 bushels per acre. The hay and clover was a somewhat lighter crop than that of 1908, but brought a higher price per ton, so that the return to the Ontario farmer from this crop was about $60,618,000, being nearly 3½ million dollars more than for the crop of 1908.

In Quebec, cold weather prevailed during the months of May and June, but in July and August heat and rain quickened vegetation and, with good harvest weather, a crop was secured considerably above the average of the previous year. Winter wheat is not grown in Quebec; of spring wheat, the total crop was 1,679,000 bushels, with a

yield of 16·71 bushels per acre; of oats, the total crop was 42,501,000 bushels, with an average of 27 bushels per acre, and of barley, 2,604,000 bushels, with an average yield of 24.02 bushels per acre. Of potatoes, the total yield was 30,853,000 bushels, the money value of which was $10,490,000. The hay and clover crop brought the farmers of Quebec $44,440,000.

In the Maritime Provinces, the spring of 1909 opened late, much of the weather in June was dry and cold, but this was followed by excellent growing conditions which brought the grain crops on rapidly, so that the yield in harvest was up to or above the average. Spring wheat yielded heavier crops than in Ontario. In Nova Scotia, the average was 19·80, in New Brunswick 20·15, and in Prince Edward Island 20 bushels per acre. Oats, of which there was a combined yield of 16,334,000 bushels, did not average quite so high per acre as in Ontario. Barley also fell short of the Ontario average. The crop of potatoes brought the farmers of the Maritime Provinces $9,703,000, while the hay and clover crop brought in about $25,000,000.

In Manitoba, the spring weather was unusually cold with frosty nights, which delayed seeding for two or three weeks beyond the usual period. In June and July the weather was very favourable for growth and the yields of all kinds of grain were well up to the average, wheat being generally above that point. The total wheat crop in Manitoba was 52,706,000 bushels, with an average yield of 18·77 bushels per acre. This, it is estimated, brought nearly forty-six million dollars; the oat crop also brought over seventeen millions and the barley crop about eight million dollars.

In Saskatchewan, the spring season opened fairly early and seeding was very general from April 15 to 25. Under the influence of favourable showers and genial heat, grain made a rapid growth. The somewhat heavy rains of the first half of August caused a rank growth of straw which, in some places, was followed by rust with some shrunken grain and a lessening of the yield. No severe frosts occurred until late in September when nearly all the grain was cut. The total yield of wheat in this province was extraordinary, amounting to 85,197,000 bushels, with an average of 23·13 bushels per acre. This, it is estimated, gave a return to that province of over sixty-eight million dollars. The total yield of wheat showed an increase over that of 1908 of more than fifty million bushels. The total crop of oats was 91,796,000 bushels, which gave the unusually high average of 49·70 bushels per acre. The total value of this crop is placed at over twenty-three million dollars. The crops of barley and flax united gave nearly four million dollars, and potatoes, which produced an average of 235 bushels per acre, still another one and one-half million dollars.

In Alberta, the crop of winter wheat, which lies mostly south of the main line of the Canadian Pacific railway, amounted to 2,009,000 bushels, with an average yield of 24·80 bushels per acre. The spring opened early, which admitted of earlier seeding than usual. Spring wheat gave a total crop of 7,570,000 bushels, with an average yield of 24·90 bushels per acre. The oats in that province gave a total crop of 38,376,000 bushels, with an average production of 46·80 bushels per acre. The barley crop was much smaller, the total being 5,999,000 bushels, giving an average of 32·25 bushels per acre. The total value of the crops of spring grain in Alberta was about 18½ million dollars. Potatoes gave a crop of 2,599,400 bushels, which returned to the farmers of Alberta over a million dollars.

In British Columbia, no statistics are available outside of the regular census, taken every ten years. The spring of 1909 was cold and somewhat late, but subsequent warm weather made the season on the whole a favourable one. At the Experimental Farm at Agassiz, the twelve varieties of spring wheat under test gave an average of 22 bushels 31 lbs. per acre. Twenty-two varieties of oats gave an average of 79 bushels 28 lbs. per acre and twenty varieties of barley an average of 46 bushels 20 lbs. per acre. The average of fifteen varieties of peas was 41 bushels 16 lbs. per acre and that of twelve varieties of turnips 40 tons 115 lbs. per acre.

CO-OPERATIVE EXPERIMENTS BY FARMERS THROUGHOUT CANADA.

Another distribution was made this year from the Experimental Farms to Canadian farmers of samples of seed of high quality for the improvement of crops. The object in view in this distribution was to ascertain by test the relative merits of the different sorts under trial, as to quality, productiveness and earliness in ripening. In conducting these trial plots, farmers everywhere have readily undertaken to co-operate with the Experimental Farms and to report the results of their experiments. These joint efforts have been productive of much good, and a great deal of information has thus been gathered as to the suitability of these different varieties to the climatic conditions prevailing in different parts of Canada.

During the season of 1909 the number of Canadian farmers who have united in these experiments was 50,396. The value of this work in all parts of the Dominion has been abundantly demonstrated.

The samples sent from the Central Farm have weighed as follows: Wheat and barley, five pounds each, and oats, four pounds, sufficient in each case to sow one-twentieth of an acre. The samples of Indian corn, peas and potatoes have weighed three pounds each.

DISTRIBUTION OF SAMPLES BY PROVINCES.

Name of Grain.	Prince Edward Island.	Nova Scotia.	New Brunswick.	Quebec.	Ontario.	Manitoba.	Saskatchewan.	Alberta.	British Columbia.
Oats	383	1,176	1,367	5,345	2,314	614	1,135	847	108
Barley	81	457	200	1,802	586	234	427	339	42
Wheat	167	647	528	2,813	587	778	2,331	1,009	32
Peas	20	275	151	788	318	172	357	310	59
Indian Corn	21	131	107	512	478	53	58	35	40
Potatoes	51	833	312	4,115	3,513	1,094	3,020	1,338	541
Total	723	3,519	2,665	15,375	7,796	2,945	7,328	3,878	822

Total number of samples distributed, 45,051.

Total number of packages of each sort distributed:—

Oats	13,289
Barley	4,168
Wheat	8,892
Peas	2,450
Indian Corn	1,435
Potatoes	14,817
Total	45,051

The following list shows the number of packages of the different varieties which have been sent from the Central Experimental Farm:—

Name of Variety.	Number of Packages.
Oats.	
Banner	6,920
Danish Island	1,494
Wide Awake	1,325
White Giant	1,204
Improved Ligowo	1,111
Thousand Dollar	747
Daubeney	488
Total	13,289
Barley (Six-Row.)	
Mensury	2,188
Odessa	377
Mansfield	300
Claude	196
(Two-Row.)	
Invincible	397
Canadian Thorpe	375
Standwell	299
Sidney	36
Total	4,168
Spring Wheat.	
Red Fife	4,024
Preston	1,759
White Fife	716
Pringle's Champlain	457
Marquis	407
Stanley	381
Percy	331
Huron	321
Chelsea	317
Bobs	179
Total	8,892

Name of Variety.	Number of Packages.
Peas.	
Golden Vine	1,757
Arthur	693
Total	2,450
Indian Corn.	
Longfellow	410
Angel of Midnight	281
Selected Leaming	270
Compton's Early	264
North Dakota White	70
Early Mastodon	64
White Cap Yellow Dent	63
Champion White Pearl	13
Total	1,435
Potatoes.	
Rochester Rose	3,406
Money Maker	2,094
Gold Coin	1,847
Irish Cobbler	1,505
Carman No. 1	1,433
Queen of Hebron	1,271
Dooley	885
Early Manistee	508
Banner	395
Empire State	362
American Wonder	293
Late Puritan	246
Burpee's Extra Early	189
Ashleaf Kidney	168
Twentieth Century	140
White Seedling	75
Total	14,817

DISTRIBUTION OF SAMPLES FROM THE BRANCH EXPERIMENTAL FARMS.

Samples were also distributed from the Branch Experimental Farms as follows:—

Experimental Farm, Nappan, N.S.—

Spring Wheat	80
Oats	350
Barley	57
Buckwheat	25
Potatoes	252
	730

Experimental Farm Brandon, Man.—

Wheat	51
Oats	48
Barley	22
Peas	17
Potatoes	252
	390

Experimental Farm, Indian Head, Sask.—

Spring Wheat	206
Oats	155
Barley	52
Peas	60
Sundries (flax, rye)	14
Potatoes	500
	987

Experimental Farm, Lacombe, Alta.—

Winter Wheat	167
Spring Wheat	264
Oats	219
Barley	110
Potatoes	541
	1,315

Pæonies at Central Experimental Farm, Ottawa.

Photo by C. E .Saunders.

Experimental Farm, Lethbridge, Alta.—		*Experimental Farm, Agassiz, B.C.—*	
Winter Wheat	167	Spring Wheat	17
Spring Wheat	299	Oats	241
Barley	95	Barley	29
Oats	170	Peas	47
Potatoes	568	Potatoes	290
	1,299		624

By adding the number of farmers supplied by the branch Farms to those supplied by the Central Farm, we have a total of 50,396. The average number of samples sent out each year for the past eleven years has been over 38,000.

It is remarkable how rapidly a supply of grain may be built up from a single four or five-pound sample. Take, for instance, a sample of oats. The four pounds received will, if well cared for, usually produce from three to four bushels. This, sown on two acres of land, will, at a very moderate estimate, give one hundred bushels, and sometimes much more, but taking the lower figure as the basis for this calculation, the crop at the end of the second year would be sufficient to sow fifty acres, which, at the same moderate comparison, would furnish 2,500 bushels available for seed or sale at the end of the third year.

The critical point of these tests is the threshing of the grain at the end of the first season, and it is here that some farmers fail to get the full advantage of the experiment. The product of the one-twentieth acre plot is sometimes threshed in a large machine, which it is difficult to thoroughly clean, and in this way the grain becomes mixed with other varieties and with weed seeds and is practically ruined. At the Central Experimental Farm we thresh the produce of many of the small plots of grain by cutting off the heads, placing them in sacks and beating them with a stick, then winnowing until most of the chaff is got rid of, and the grain made clean enough for sowing.

Where the farmer is to use this seed for his own sowing it is not necessary that the sample be entirely free from chaff. It is, however, most essential, if he is to get the full benefit of his experiment, that the grain be quite free from all admixture with other sorts of grain or with weeds. Farmers are expected to harvest the product of their experimental plot separately, and store it away carefully, threshing it by hand either with a flail or in such other manner as they may prefer. The results to be gained will abundantly repay the cost of careful handling of the grain.

Every season after the regular free distribution of the samples has been provided for, the surplus grain grown on the Experimental Farms not required for sowing is sold to farmers in quantities of from 2 to 6 bushels or more each. In this way, a considerable number of farmers are supplied every year with seed grain in these larger quantities, especially from the branch Farms at Brandon, Manitoba; Indian Head, Saskatchewan; and at Lethbridge, Alberta.

ADDITIONS TO THE STAFF OF THE EXPERIMENTAL FARMS.

Following the death of our esteemed coadjutor, Dr. Jas. Fletcher, it was thought best by the Hon. Minister to reorganize the Division of Entomology and Botany which had been under Dr. Fletcher's charge, and to arrange for two separate Divisions, one of Entomology and one of Botany.

The position of Entomologist was given to Dr. C. Gordon Hewitt and that of Botanist to Mr. H. T. Güssow.

Dr. Charles Gordon Hewitt was educated at the Macclesfield Grammar School and the University of Manchester, England, where he obtained zoology, botany and Dalton natural history prizes; he graduated in 1905 as bachelor of science, with first-class honours in zoology, and was awarded a university graduate scholarship. He was appointed the same year as assistant lecturer and demonstrator in zoology in the Manchester University, and, two years later, was appointed to the newly-instituted lectureship in economic zoology, which he resigned on accepting the post of entomolo-

gist to the Dominion. The degree of Master of Science was conferred in 1907 for research and the degree of Doctor of Science was conferred in 1909, for his researches in economic zoology, especially entomology. Dr. Hewitt has made a special study of insects, and has also studied at various fresh water and marine biological stations and has made a special investigation of those animals and parasites which affect agriculture, horticulture and forestry.

His chief work has been upon the house fly, especially in its relation to public health and the results of his investigations, extending over a number of years, are comprised in a detailed monograph, beautifully illustrated, published in the Quarterly Journal of Microscopical Science, 1907-1909. In this connection, he has assisted in an inquiry of the British local government board on the carriage of infection by flies. He has also investigated the life-histories, &c., of other injurious insects.

He is a Fellow of the Entomological Society, joint honorary secretary of the Association of Economic Biologists, and of the Manchester Literary and Philosophical Society, and a foreign member of the American Association of Economic Entomologists.

Mr. Hans T. Güssow is a native of Breslau, Silesia. He received his scientific training at the German universities of Breslau, Leipsic and Berlin, specializing in applied botany and subsequently in plant diseases caused by microscopic fungi and bacteria. He proceeded to England in 1901, and, in 1903, entered the botanical laboratory of Dr. William Carruthers, F.R.S., the eminent British botanist, who for thirty-seven years has occupied the position of consulting botanist to the Royal Agricultural Society of England, and who was formerly in the natural history department of the British Museum. In the capacity of assistant to Dr. Carruthers, Mr. Güssow has necessarily been brought into contact with British agriculturists and has studied carefully the botanical problems with which land owners and practical farmers are called upon to deal, including such subjects as the destruction of larch forests by the larch disease, clover-sick land, potato diseases, and the effects of poisonous and of injurious weeds. In this connection, he has done a good deal of original research. He was also an active member of the scientific committee of the Royal Horticultural Society. He is a Fellow of the Royal Microscopical Society and has served upon its sectional committee for medical bacteriology and histology. He is also a member of the Association of Economic Biologists, of the Association of Economic Botany, of the Société Mycologique de France and of other learned bodies. His scientific articles are artistically illustrated with reproductions from his own drawings and photographs.

Both of these Divisions of the work of the Experimental Farms have been well equipped with apparatus and books and the officers have entered on their work with energy and thoroughness. The excellent work done by these gentlemen in the past leads us to anticipate a brilliant future for these two Divisions of the Farm work.

BULLETINS AND PAMPHLETS ISSUED DURING THE YEAR ENDING MARCH 31, 1909.

Four new bulletins were issued during the year and a second edition of Bulletin No. 51, Bacon Pigs in Canada, the first edition of which was exhausted.

The new bulletins issued were the following:—

Bulletin 62, of the Experimental Farm Series, by W. T. Macoun, Dominion Horticulturist, on Strawberry Culture. This contains a short history of the improvement of the strawberry, and its methods of propagation, preparation of the soil, treatment of plants, cultivation and winter protection are fully dealt with. Lists of varieties notable for such characteristics as earliness, firmness of fruit, large size, attractiveness and hardiness are given, as well as a very complete description of the varieties which have been tested at the Central Experimental Farm.

Bulletin 63, A Serious Potato Disease occurring in Newfoundland, by H. T. Güssow, Dominion Botanist, was issued to call the attention of the Canadian potato-growers to a disease called Potato-canker which had appeared in Newfoundland. This

disease, which is quite widely spread in Europe, is fully described aud its history given. Methods of prevention and of dealing with it where present are prescribed.

Bulletin No. 64 of the Experimental Farm series was prepared jointly by the Cerealist, Dr. C. E. Sauuders, and myself. This treats of the results obtaiued on all the Dominion Experimental Farms from trial plots of grain, fodder corn, field roots and potatoes, in 1909. This is the fifteenth issue of this special publication. There are presented in this bulletiu the results of a large number of experiments which have been conducted at all the Dominion Experimental Farms during the season of 1909 with spring and winter wheat, oats, barley, peas, Indian corn, turnips, mangels, carrots, sugar beets and potatoes. The average results are also given for the past five years of the comparative tests of those varieties which have been long uuder trial, and these records are arranged in the order of their yield.

These trial plots are conducted with the object of gaining information as to the relative productiveness of the different sorts and their earliness in ripening in the different climates of Canada. The returns show much variation in the weight and earliness of the crops grown, and point to the importance of care in the choice of varieties of seed for sowiug.

Bulletin 65, on Growing and using Corn for Ensilage, by J. H. Grisdale, B. Agr., Dominion Agriculturist, indicates the value of corn ensilage as a fodder plant. Suitable varieties of corn are given for the differeut climates of Cauada aud methods of cultivating, harvesting and ensiloing described. Rations, including ensilage, are worked out and the cost of growing and harvesting this crop is stated. Illustrations are furnished of the machines and processes involved in growing this crop.

Two pamphlets were also issued during the year, No. 7 by W. T. Macoun, Dominion Horticulturist, ou Ginseng and Melon Culture, and Poultry Circular No. 6 by the Poultry Division, giving a plan of a cotton-front poultry house.

CORRESPONDENCE.

The correspondence carried on during 1909-10 between the farmers of Canada and the officers of the Experimental Farms has been very large.

CENTRAL EXPERIMENTAL FARM.

The following is a summary of the letters and reports sent out at the Central Experimental Farm from April 1, 1909, to March 31, 1910:—

	Letters received.	Letters sent.
Director	60,519	22,813
Agriculturist	3,551	6,016
Horticulturist	2,602	2,487
Chemist	2,104	1,929
Entomologist	1,267	1,683
Botanist	518	725
Cerealist	491	425
Poultry Manager	4,834	5,773
Accountant	1,398	2,697
	77,284	44,548

Many of the letters received by the Director are applications for samples of seed grain or for the publications issued by the Experimental Farms; many of these are answered by mailing the material asked for, accompanied in most instances by circular letters. This will explain why the number of letters received by that officer so much exceeds the number sent out.

DISTRIBUTION OF REPORTS, BULLETINS AND CIRCULAR LETTERS.

Reports and bulletins mailed	305,150
Circulars and letters relating to samples of seed grain	41,241
	346,391

BRANCH EXPERIMENTAL FARMS.

The correspondence conducted by the Superintendents of the Branch Experimental Farms is also large, as is shown by the following figures:—

	Letters received.	Letters sent.
Experimental Farm, Nappan, N.S.	2,301	2,011
" " Charlottetown, P.E.I.	160	122
" " Brandon, Man.	3,006	2,864
" " Indian Head, Sask	6,963	6,908
" " Rosthern, Sask.	350	308
" " Lethbridge, Alta.	3,748	3,518
" " Lacombe, Alta.	4,248	3,571
" " Agassiz, B.C.	4,751	4,506
	25,527	23.808

Much additional information has also been sent out from the Branch Farms by printed circulars. By adding the correspondence conducted at the Branch Farms to that of the Central Farm, the total number of letters received is found to be 102,651 and of those sent out, 68,134.

TESTS OF THE VITALITY OF SEED GRAIN AND OTHER SEEDS.

The following report includes tests of grain and other seeds grown on the several Experimental Farms, as well as those bought with the object of growing them on the Farms. The list also includes tests of the vitality of a number of specimens of grain grown in the several provinces of the Dominion, from the samples distributed from the Central Experimental Farm. These tests have been made with the object of ascertaining what climatic conditions are most favourable for producing seed of high vitality, and how far this desirable quality is likely to be influenced by variations in character of season. Formerly these tests included a number of doubtful samples which were believed, by the parties sending them, to have been injured in their vitality by exposure to unfavourable conditions. All such samples are now referred to the Seed Commissioner for report. The results reported on here are the average proportions of vitality shown by samples of grain grown in different parts of the several provinces of Canada, under healthy and normal circumstances. In the following table, showing the results by provinces, the total percentage of vitality is given, also the percentage of strong and weak growth.

RESULTS of Tests of Seeds for Vitality, 1909-10.

Kind of Seed.	Number of Tests.	Highest Percentage.	Lowest Percentage.	Percentage of Strong Growth.	Percentage of Weak Growth.	Average Vitality.
Wheat	438	100·0	36·0	86·9	3·0	89·9
Barley	328	100·0	52·0	85·5	5·8	91·4
Oats	402	100·0	39·0	85·6	4·1	89·7
Rye	8	95·0	64·0	80·5	3·3	83·8
Peas	139	100·0	42·0	.....	.....	87·8
Corn	28	100·0	16·0	.....	.....	81·8
Flax	19	97·0	42·0	.....	.....	79·6
Carrots	11	64·0	25·0	.....	.....	45·5
Beans	5	100·0	86·0	.....	.....	95·6
Grass	2	88·0	86·0	.....	.....	87·0
Clover	3	91·0	61·0	.....	.....	77·0
Cabbage	1	.....	.....	.....	.....	88·0
Radish	1	.....	.....	.....	.....	78·0
Total number of samples tested, highest and lowest percentage	1,385	100·0	16·0	.....	.....	.....

TABLE showing Results of Grain Tests for each Province for 1909-10.

Kind of Seed.	Number of Tests.	Highest Percentage.	Lowest Percentage.	Percentage of Strong Growth.	Percentage of Weak Growth.	Average Vitality.
ONTARIO.						
Wheat	79	100·0	41·0	84·9	4·3	89·3
Barley	62	100·0	54·0	82·6	7·0	89·6
Oats	70	100·0	80 0	92 2	2·4	94·6
QUEBEC.						
Wheat	38	100·0	70·0	90 1	2·3	92·4
Barley	38	100·0	80·0	89·2	5·0	94·3
Oats	27	100·0	78·0	89·7	3·2	93·0
MANITOBA.						
Wheat	51	100·0	72·0	88·0	2·7	90·7
Barley	38	99 0	81 0	87·9	5·7	93·6
Oats	41	100·0	57·0	88 6	3·9	92·6
SASKATCHEWAN.						
Wheat	87	100·0	36 0	86·8	3·3	90·1
Barley	45	100·0	80 0	86 0	7·2	93·2
Oats	56	100 0	52·0	83 3	4·2	87·5
ALBERTA.						
Wheat	76	100 0	61·0	87·7	2 7	90·5
Barley	65	100 0	52 0	87 0	4 1	91·1
Oats	85	100 0	39 0	72·8	7 9	80·7
NOVA SCOTIA.						
Wheat	54	100 0	44·0	80·3	2 9	83 3
Barley	50	100 0	72·0	83.7	6 4	90 1
Oats	47	100 0	78·0	89·6	2·5	92 2
NEW BRUNSWICK.						
Wheat	18	100·0	64·0	89 8	1·3	91·2
Barley	4	96·0	83·0	78 2	11·5	89·7
Oats	26	100 0	81·0	90 0	2·7	92 7
PRINCE EDWARD ISLAND.						
Wheat	22	100·0	84.0	92·5	2·5	95·1
Barley	4	95·0	68 0	84·5	3 0	87 5
Oats	24	100·0	89 0	93·8	1 7	95·6
BRITISH COLUMBIA.						
Wheat	13	100·0	92 0	94 5	1·1	95·6
Barley	22	99·0	61·0	84·2	4 7	88·9
Oats	26	100·0	66·0	86·9	3·5	90·4

(Signed) WILLIAM T. ELLIS.

METEOROLOGICAL OBSERVATIONS.

TABLE of meteorological observations taken at the Central Experimental Farm, Ottawa, from April 1, 1909, to March 31, 1910, giving maximum, minimum and mean temperature for each month, with date of occurrence; also rainfall, snowfall and total precipitation.

Month.	Maximum.	Minimum.	Range.	Mean.	Highest.	Date.	Lowest.	Date.	Rainfall.	Snowfall.	Total Precipitation.	Number of days Precipitation.	Heaviest in 24 hours.	Date.
	°	°	°	°	°		°							
April	46·01	28 96	17 04	37·46	64 0	13th	14 5	10th	2·96	7·50	3·71	16	0·83	19th
May	63·15	44 04	19·10	53·59	75 5	14th	30 5	4th	5·84	s	5·84	22	1·34	1st
June	77·91	53 45	24 46	65·68	91·8	22nd	39 9	18th	2·52	.....	2·52	9	0·83	14th
July	77·36	56 97	20·38	67·16	89 8	15th	47·0	9th	4 69	......	4·69	17	1·09	18th
Aug	80·16	55 80	24 35	67·97	95·6	25th	42·0	22nd	3·11	......	3·11	11	1·25	16th
Sept	67·84	47·85	19·99	57·84	84·8	14th	36·6	29th	2·81	.. .	2·81	15	0·59	4th
Oct.	53·70	36 79	16 90	45 24	76 8	10th	21·8	30th	1·11	s	1·11	10	0·35	15th
Nov.	42·86	28 42	14 44	35·64	63 6	12th	6·0	24th	2 93	2·50	3·18	13	1 10	23rd
Dec.	24·31	13·47	10·84	18·89	36 0	8th	− 8·8	29th	.....	15·00	1·50	10	0 65	14th
Jan.	25·87	9·94	15 92	17·90	41·0	22nd	−18 5	5th	1·36	9·50	2·30	16	0 70	22nd
Feb.	22·45	3 32	19·13	12·?8	43·4	28th	−19·4	7th	0·08	22 25	2·30	12	0 70	12th
Mar.	42·64	24·55	18 08	33·59	72 6	28th	− 3·3	18th	0 99	4·50	1 44	11	0·44	7th
									28·40	61·25	34·51	162		

Rain or snow fell on 162 days during the 12 months.
Heaviest rainfall in 24 hours, 1·34 inches on May 1st.
Heaviest snowfall in 24 hours, 7·00 inches on February 12th.
The highest temperature during the 12 months was 95·6° on August 25th.
The lowest temperature during the 12 months was—19·4° on February 7th.
During the growing season, rain fell on 16 days in April, 22 days in May, 9 days in June, 17 days in July, 11 days in August, and 15 days in September.
June shows the lowest numbers of days with precipitation, viz.: 9.
Total precipitation during the 12 months 34·51 inches, as compared with 32·91 inches during 1908–09.

RAINFALL, snowfall and total precipitation from 1890 to 1909-10, also the average annual amount that has fallen.

Year.	Rainfall.	Snowfall.	Total Precipitation.
1890	24 73	64.85	31·22
1891	30·19	73 50	37·54
1892	23·78	105 00	34 28
1893	31 79	72 50	39·04
1894	23 05	71 50	30·20
1895	27·01	87 50	35·76
1896	21·53	99 75	31·50
1897	24 18	89 00	33·08
1898	24·75	112 25	35·97
1899	33 86	77 25	41·63
1900	29 48	108 00	40·72
1901	29·21	97·25	38·91
1902	25·94	101·75	36 10
1903	26 43	85·00	34·92
1904	25·95	108 75	36·79
1905	23·71	87·25	32.42
1906, January 1 to March 31	1 90	24·50	4·34
1906-07	21·73	72·50	28·94
1907-08	24·70	134·75	38·18
1908-09	22·13	107·90	32·91
1909-10	28·40	61·25	35·51
Total for 20 years and 3 months	524·45	1,842·00	708·96
Average for 20 years	26·22	92·10	35·44

RECORD of sunshine at the Central Experimental Farm, Ottawa, from April 1, 1909, to March 31, 1910.

Month.	Number of days with Sunshine.	Number of days without Sunshine.	Total hours Sunshine.	Average Sunshine per day.
April	23	7	172·7	5·75
May	27	4	195·5	6.30
June	29	1	255·0	8 50
July	29	2	236·9	7·64
August	30	1	279·7	9·02
September	29	1	190·6	6·35
October	28	3	134 8	4·34
November	26	4	87 9	2 93
December	18	13	59·4	1·91
January	22	9	88·8	2·86
February	23	5	124 1	4·43
March	28	3	214 8	6 92

(Signed) WILLIAM T. ELLIS,
Observer.

MEETING OF THE BRITISH ASSOCIATION.

Early in the summer of 1909, I was invited by the British Association for the Advancement of Science to prepare, for the meeting of the Association to be held in Winnipeg during the last week in August, a paper on the Development of the Dominion Experimental Farms. This was duly presented on August 27 as follows:—

DEVELOPMENT OF THE DOMINION EXPERIMENTAL FARMS.

By Dr. WM. SAUNDERS, C.M.G.,

Director, Dominion Experimental Farms.

At the meeting of the British Association held at Bradford, Yorkshire, in 1900, it was my privilege to bring before the Association some of the results of the experimental work in agriculture conducted in Canada under the Dominion Government in connection with the Experimental Farms.

On that occasion, I reviewed briefly the depressed condition of agriculture which prevailed in Canada prior to 1884. In that year, the House of Commons appointed a Select Committee to inquire as to the best means to adopt to encourage and develop the agricultural interests of Canada, in the prosperity of which all classes of the community were deeply concerned. The report of that Committee showed that agriculture, the most important national industry of the country,—one in which more than half the entire population were engaged—was in a lamentable and discouraging condition. The evidence brought forward showed that there was no lack of fertility in the soil and that climatic conditions were favourable for the production of good crops, but that the depression was due to a wide-spread condition of ignorance among the farming community. This lack of information led to defective farming and the adoption of wasteful methods.

At that time no means had been provided to help the farmer in the many difficulties which beset his path. Ill-rewarded and discouraged in his work, he had no one to look to for advice and assistance. Thus agriculture made little or no progress.

The Parliamentary Committee recommended the establishment of Experimental Farms, where tests should be carried ou in all branches of agriculture and of horticulture, and that the results of this work should be published from time to time and disseminated freely among the farmers of the Dominion. Action on this report was soon taken and, during the session of Parliament for 1886, an Act was introduced and passed almost unanimously, authorizing the Dominion government to establish a Central Experimental Farm and four Branch Farms. The Central Farm was located near Ottawa, Ontario; the Branch Farm for the Maritime Provinces at Nappan, Nova Scotia; that for Manitoba at Brandon; the Farm for the Northwest Territories at Indian Head; and that for British Columbia at Agassiz.

This work, as set forth in the Act under which the Farms were established, covered all the more important branches of agriculture, horticulture and arboriculture. It has been carried on most actively and efficiently by a competent staff and was arranged so as to cover first those subjects on which farmers were in the greatest need of information. Investigation and experimental research work have been carried on along all the more important lines and a great mass of facts accumulated, many of which have been given to the farmers of this country from time to time, in the reports and bulletins which have been distributed.

Among all the forms of employment which engage man's attention, there are few which require more ability to conduct successfully than farming. Competition in food products is keen throughout the civilized world and farmers everywhere must turn to practical account every advantage within their reach affecting the quality and cost of their productions, if they are to improve their condition.

Twenty-two years have now passed since this work was inaugurated and, during that time, agriculture has made great advancement. The progress referred to has brought about a wonderful improvement in the condition of the farming population and an enormous increase in the exports of agricultural products.

The Experimental Farms have become bureaus of information, to which farmers in all parts of the Dominion apply for advice and direction in times of difficulty, when confronted with problems which they are unable to solve. Nine years ago, the number of letters received per annum at all the Experimental Farms was 69,669. By the year ended March 31, 1909, the number had increased to over 100,000. There has also been an increase during the same period of nearly 100,000 in the number of reports and bulletins distributed. There is thus a constant stream of information going out to Canadian farmers, much of it in response to direct personal application.

Nine years ago, when this subject was first brought before the British Association, the work had grown very much, and during the period which has since elapsed it has been still further extended, especially in the Canadian Northwest. When the two western provinces of Saskatchewan and Alberta were carved out of what had been known hitherto as the Northwest Territories, Saskatchewan was given a land area of 242,332 square miles (nearly 161,000,000 acres,) and a water area of 8,318 square miles. To Alberta was given a land area of 251,180 square miles (about 155,000,000 acres), with a water area of 2,360 square miles, each province extending from the 49th to the 60th parallel of latitude, a distance of 760 miles. The area of these two provinces is said to be as large as the united areas of Great Britain, France and Germany.

The only Experimental Farm then in operation to serve this vast territory was that at Indian Head, in the southern part of Saskatchewan. Since then, another Branch Farm has been put in operation at Rosthern, in Northern Saskatchewan, 200 miles north of the Canadian Pacific railway and 50 miles south of Prince Albert. Two Branch Farms have also been established in Alberta, one for Southern Alberta at Lethbridge, on the Crow's Nest line of railway, 108 miles from Medicine Hat, and one for Central Alberta at Lacombe, 80 miles south of Edmonton, while the northern part of the country is served by a small Branch Station on the farm of one of the older settlers at Fort Vermilion, on the Peace River, about 400 miles directly north of Edmonton, or 700 miles distant from that city by the regular mail route.

Farther west, the Branch Farm at Agassiz has been doing good work for the past twenty-two years, and recently a suitable site has been chosen in British Columbia for carrying on experiments in what is known as 'dry-farming.' This new station is in the vicinity of Kamloops, where ten acres of land are being devoted to experiments with the more important farm crops.

Negotiations are in progress for a Branch Farm on Vancouver Island, B.C. It is also expected that another will be located within the dry interior district of British Columbia, probably in one of the larger fruit-growing areas.

At the other extremity of the Dominion, in Prince Edward Island, a Branch Experimental Farm, containing about 65 acres, has recently been established near the city of Charlottetown and this is now being prepared for experimental work in the spring of 1910.

The five original Experimental Farms have thus been increased to nine, with three additional smaller stations. Two of the latter have already been referred to; the third is near Lake Abitibi in Quebec, near the line of the Grand Trunk Pacific railway, a short distance from the boundary line between that province and Ontario. It will thus be seen that the number of stations for carrying on experimental work has more than doubled within the past five years and it is probable that further extension in this direction will be made before long.

Permit me to refer briefly to the special lines of work which have been carried on at the Central Farm from the beginning, and to refer later to each branch farm and experiment station, noting some of the special courses of experiments which have been, or will be, conducted at each.

At all the Farms, experiments are conducted each year on what are known as uniform trial plots, where a number of varieties of the more important farm crops are tested to ascertain their relative productiveness, quality and earliness in maturing. This list includes varieties of spring wheat, oats, barley, peas, Indian corn, turnips, mangels, sugar beets and potatoes. The merits of each of the different sorts on this list are carefully inquired into every year and the crops produced in the different climates of the Dominion compared. Any of those varieties which show any serious defects are discarded and the list thus reduced, unless there are any new sorts available of sufficient promise to warrant their being placed in this special group.

In some products, frequent changes are made in this list, on account of the many new varieties obtainable. Take, for example, wheat, which is the leading crop in the Dominion.

The Dominion Cerealist is continually producing, by cross-breeding and selection, a large number of new sorts. He thoroughly tests each one before it is admitted into the special list. Its quality must be excellent, its earliness undoubted and its productiveness satisfactory. The tests, to which all are subjected, include the grinding of the wheat into flour and the baking from it of bread. These experiments are many times repeated. Chemical analyses of the flour are also made in the Chemical Division. If a wheat after many trials maintains a good reputation, it is continued in the trial plots and grown also in larger plots for more general distribution. The new sorts are thus grown alongside of a few of the very best of the older ones, where the relative merits of each may be ascertained and any weak points discovered.

Similar experiments are carried on with oats, where earliness of ripening, productiveness, thinness of hull, stiffness of straw and rust-resisting power are all points of excellence which are diligently sought for, and as many of these good qualities as possible must be combined in a variety before a place can be given it on the select list. The total production of oats in Canada, in 1908, was 250,377,000 bushels. This, when compared with the total wheat production during the same year, of 112,444,000 bushels, shows the relative importance of oats in our great agricultural undertakings. This grain, being rich in nutritive qualities, is most important to all farmers, forming the chief grain food for horses and being also an important ingredient in the food used

for fattening cattle and swine. The Dominion Cerealist has also produced many excellent varieties of barley and new strains of oats, peas, flax, beans, &c. The field of work covered by him is a very large one and includes much of the labour of preparing and supplying material for the uniform trial plots conducted at all the experimental farms.

The Dominion Agriculturist's Division covers the care of cattle, horses, swine and sheep. He breeds and selects animals with special qualifications for particular purposes, adding from time to time individuals of great excellence to the several herds and thus replacing less valuable specimens. Many good animals are also sent to the Branch Farms. In the four classes of dairy animals kept at the Central Farm at Ottawa, a faithful record is kept of the quantity of milk produced by each animal and the proportion of butter-fat it contains. By this method, unprofitable animals are promptly detected and eliminated, thus increasing the average productiveness of the whole herd. During the past ten years, the milk production of the dairy herd at Ottawa has been increased from an average of about 4,000 lbs. to nearly 8,000 lbs. per annum. Farmers everywhere have been encouraged to keep records of the milk given by the individual members of their herds and printed forms for taking the daily records of milk production have been supplied free to all those desiring to use them. Some farmers who have used these forms have, by this process of selection, more than doubled the returns from their herds.

The Dominion Agriculturist has also paid much attention to the ventilation and cleanliness of barns and stables, so that pure air and wholesome food may contribute to the successful development of the animals under test. Many feeding trials have been conducted to gain experience in the fattening of cattle, swine and sheep so as to ascertain how the highest quality of beef, pork and mutton may be most economically produced. Extensive experiments have been carried on in the growing of Indian corn or maize, and the making of ensilage from this crop. These improvements have shown the way to profitable fields for further investigation in dairying and cattle feeding, which many of the more intelligent farmers in Canada are profitably following.

Many experiments have also been conducted along other lines, especially with reference to the preparation and treatment of the soil and at the same time emphasizing the importance of a suitable rotation of crops.

The horticultural field has also been well covered and the various lines of experimental work carried on with much industry and success. In the production of new varieties of apples, the Dominion Horticulturist has already made for himself an enviable reputation. Out of many hundred varieties which have been produced by him, there are quite a number which are of high quality and great promise, some of which will, no doubt, shortly find their way into the large orchards of the country and thus become available to the public in the home and foreign markets.

In other fruits, also, both large and small, much good work has been done. In the growing of vegetables as well, many varietal and other tests have been undertaken and much useful information obtained. The lists of the best selections of the different varieties of vegetables given for the guidance of farmers have been very helpful. Several special pamphlets have been prepared on the growing of vegetables, giving particulars of the cultural methods which have been most successful. The Horticultural Division carries on other lines of work, among the more important of which may be mentioned the experiments with potatoes, the spraying of fruits and plants for the subjugation of injurious insects and fungous diseases, the care of the Arboretum and of the forest belt.

The Chemical Division fills an important place in the organization of the Experimental Farms. The analysis of cereals, fodder plants and other important farm crops to determine the proportions of their more important constituents, and when these crops may be harvested to the greatest advantage, has received much attention. Special care has been given to the analysis of soils, both virgin and cultivated, from

various parts of Canada, to ascertain their condition as to fertility, and suggestions have been made as to the best means to adopt for the economic maintenance and increase of their crop-producing power.

Many milling and other by-products sold for feeding stock in Canada have been examined and their relative feeding value determined. Analyses have been made to ascertain the manurial value of certain naturally-occurring fertilizers, such as mucks, tidal deposits, marls, sea-weeds, &c., and instruction given to those who are so situated as to benefit from their use. Much information has also been given regarding the best methods of handling barn-yard manure, so as to prevent waste, also in reference to the ploughing under of green crops so as to add fertility and humus to the land.

The feeding value of many species of native grasses growing on uplands and in sloughs in different parts of the Dominion has been ascertained. The experiments conducted with wheat to find out the influence of environment on its composition, especially with reference to varying conditions of moisture, have been very instructive. The work done on frosted wheat has confirmed the general belief in the value of these lower grades of grain for feeding purposes. Much assistance has been rendered to fruit-growers by the analysis of fungicides and insecticides used for spraying purposes. The testing of well waters as found on Canadian farms has been continued and has proved of much value.

The Division of Entomology and Botany has sustained a great loss during the past year by the death of the late Dr. James Fletcher, who had charge of this division and who conducted the work most successfully and acceptably for twenty-one years. He was actively engaged in his work to within a short time of his decease and his sudden removal was sincerely regretted by all who knew him. Under Dr. Fletcher's guidance in the entomological section, much attention was paid to the study of the life-history of the many species of insects which are injurious to crops and to the testing of such remedies as have been suggested for their destruction. The habits of noxious insects which affect important grain crops were carefully studied. Attention was also given to insects affecting fodder plants, fruits, vegetables, &c.

Among the more important lines of work taken up in the section of Botany, has been the testing of the suitability of various grasses and fodder plants for profitable cultivation in Canada and the giving of information concerning noxious weeds. In the series of plots on the Central Farm devoted to the testing of grasses, useful work has been done, and, as a result of the trials made there, several very excellent grasses have been introduced into more general cultivation, especially on the Northwestern plains. Noxious weeds were made a special study by the late Dr. Fletcher, who devoted much attention to this branch. Since his death, this division has been reorganized. The Botany has been separated from the Entomology, each forming a division by itself. Mr. H. T. Güssow, late of the Botanical Laboratory of the Royal Agricultural Society of England, has been placed at the head of the Division of Botany, and Dr. C. G. Hewitt, from the University of Manchester, has been given charge of the Division of Entomology.

In the Poultry Division, much useful work has been done. New breeds of poultry have been introduced to ascertain how far they are adapted to the different climates in this country. Many experiments have been carried on in the artificial hatching and rearing of chickens, also in the breeding and cross-breeding of the different varieties. Successful efforts have been made, through special feeding, to bring on early moulting so that the hens may be brought on to lay earlier in the winter, when the prices paid for eggs are high. Tests have been made with different methods of feeding to bring about a larger production of eggs. Comparisons have also been made with the different breeds under trial as to their powers of annual egg-production. Experiments have also been carried on to gain information as to the rapidity with which the different sorts may be fattened, and their relative value for the table. Many different patterns of poultry-houses have been built and tested and the value of the colony

house demonstrated. This is a single or double-roomed, unheated house, large enough to accomodate from twenty to thirty fowls.

With the use of the trap-nest, the number of eggs laid by the individual hen is determined. Different groups of fowls have been formed, of good and poor layers, and important information gained as to their relative productiveness. The business in eggs and dressed fowls has been advanced by the publication of the results obtained from all these experiments. The diseases of poultry are also studied, and timely information given on this important subject.

The Branch Experimental Farms.

EXPERIMENTAL FARM, NAPPAN, N.S.

The Branch Farm at Nappan, Nova Scotia, is 826 miles east of Ottawa and eight miles from the boundary of New Brunswick. It is within half a mile of the Intercolonial railway station and consists of about three hundred acres. There are about fifty acres of marsh or dyke land, valuable for hay production; about fifty acres of lower upland, and about one hundred acres of higher upland. The remainder is covered with wood. This farm is fairly representative of the farms in that locality. In the maritime provinces, the spring is often very backward on account of cold, wet weather, and hence seeding is frequently delayed, necessitating fall-ploughing and the use of early-maturing varieties. At the time of the establishment of the Experimental Farm, there was very little fall-ploughing done in Nova Scotia; now it is almost universal and this change, due largely to the demonstrations made at the Nappan Farm, has resulted in better crops. Hay is the principal crop in the maritime provinces and important experiments have been conducted in the treatment of the dyke lands, on which a large part of the hay is grown.

Experiments are also carried on with grain and fodder crops. Turnips and mangels grow remarkably well there and are largely used in the feeding and fattening of stock. Potatoes also are extensively grown.

Apples have been successfully cultivated at Nappan and orchards established. Experiments have also been conducted there with pears, plums and cherries; also with most of the small fruits. Strawberries ripen there late in the season, when the crop is nearly over in other localities. Under such circumstances, the fruit commands a higher average price.

The trials undertaken with dairy cattle, also in the feeding of steers with special reference to the economical production of beef, have shown that the climate and conditions are favourable for such industries. Early-maturing varieties of cereals are also being tested.

EXPERIMENTAL FARM, CHARLOTTETOWN, P.E.I.

About sixty-five acres of land have recently been secured for an Experimental Farm near Charlottetown, about the centre of Prince Edward Island. This Farm is 995 miles from Ottawa, with a climate differing somewhat from that of Nappan. The Northumberland Straits, which lie between Nova Scotia and Prince Edward Island, usually fill with ice in the spring, which delays seeding, and on this account most crops ripen late. The summers are agreeably cool and everything matures slowly, the autumn being prolonged. The winter climate is modified and rendered milder by the proximity of the sea. Very fine crops of oats and potatoes are produced on the Island, and, in some districts, apples, cherries and most of the small fruits succeed well. Dairying is carried on successfully and much cheese is exported.

The experiments on this Farm, outside of the regular trial plots of all the more important crops, will, at first, be largely with clover and fodder plants; also with large and small fruits, and with methods of cultivating the soil and improving its fertility.

EXPERIMENTAL FARM, BRANDON, MAN.

The Branch Experimental Farm at Brandon is 1,548 miles west of Ottawa, and lies in the valley of the Assiniboine River, north of the city, and about one and one-half miles from the business centre. It consists of about 690 acres, from 200 to 250 of which being rich meadow land, along the margin of the river. Beyond this, the land rises and on this rise there are from 200 to 250 acres more of excellent land, well adapted for wheat, extending to the 'bluffs'. The bluffs vary in the angle they present to the land below; some of them rise with a gentle slope to the top, others are more or less precipitous, the spaces between them being broken up by ravines or coulées, in which grow a great variety of shrubs and trees which afford excellent shelter. The soil on these slopes and on the heights, including about 100 acres in all, is partly a sandy loam of good quality; in other places it is poor and gravelly. This is a very beautiful Farm, well planted with belts, clumps and avenues of trees. For twenty-one years this Farm has furnished object lessons to many thousands of farmers who have annually visited it and the agricultural lessons it has taught in connection with the treatment of the land and the cultivation of all sorts of crops have brought forth much fruit on many farms in Manitoba. Lessons in early sowing, proper depth to sow, quantity of seed per acre and best varieties to sow to produce an abundant crop, have been constantly given. These and many other like problems have engaged the attention of the Superintendent. Thousands of bundles of young trees grown on this Farm have been distributed among the farmers of Manitoba and used about their dwellings to make them more attractive. Tons of tree seeds, mailed in 1-lb. packages, have served a similar purpose. Many varieties of trees, shrubs and flowers serve to ornament the grounds.

Orchards for testing Russian and hardy cross-bred varieties of apples have been established, with many plantations of small fruits. Every sort of crop likely to be of value to the farmers in this western province has been tried and every effort made from year to year to demonstrate to the farmers of Manitoba the best methods to follow to increase the revenue from their farms.

EXPERIMENTAL FARM, INDIAN HEAD, SASK.

Indian Head is on the main line of the Canadian Pacific railway, in Southern Saskatchewan, 1,614 miles from Ottawa. The Farm, which adjoins the town, contains 680 acres, and has a mile frontage on the railway. When this Farm was selected, in 1887, the site was an unbroken prairie with no tree or shrub in sight as far as the eye could see. Now there are about 100,000 trees growing on this Farm in shelter belts, avenues, &c. In choosing this site, a bare prairie aspect was preferred in this instance, so that demonstration might be made of the possibility of tree planting on the plains and the opportunity afforded of showing the usefulness of trees for shelter. The surface of this Farm is slightly undulating, but nearly all of the land can be seen from the railway.

The soil is of excellent quality, most of it a friable clay loam mixed with varying proportions of sand and from one to two feet deep, with a yellowish clay sub-soil. Alhough there is not quite 200 miles distance between this Farm and that at Brandon, the climate is usually drier and hence the treatment of the soil is not quite the same. The practice of summer-fallowing, which has produced such important results in increased crops in southern Saskatchewan, was first tried in this district and its value fully demonstrated on the Experimental Farm at Indian Head. The process of the summer-fallowing of land may be described as follows:—

A farmer has, say, 300 acres of land which he desires to bring under crop. He divides this approximately into three fields of 100 acres each; two of these fields, previously prepared, he sows with grain; the other 100 acres he devotes to summer-fallow.

that is, to a bare fallow with no crop. The land to be fallowed is ploughed in the latter part of June at the time when the heavy spring rains occur, the moist soil is turned under and its capillary structure thus broken up, which prevents the escape of much moisture. Further, by this treatment millions of young weeds are buried and serve to enrich the soil. Later in the season, when the land has become more or less compact, it is treated with a suitable cultivator which tears up and destroys the later crop of weeds and pulverizes the surface, forming a mulch over the moist ground. A third cultivation is usually necessary before the season closes. The land will then be found in an excellent condition of tilth, ready to receive the seed in the following spring at the earliest moment practicable. As soon as the frost is out of the ground to a depth of six inches, the seed is sown about two inches deep. In the moist soil above the frost, the seed germinates promptly and, as the remainder of the frost thaws, the roots grow rapidly in the cool moist soil in which they are buried and, once the roots have a good start, a favourable balance is maintained between the root and top and a full, plump crop is generally had. A second crop of wheat is generally grown on stubble, the only cultivation given to the soil being with a disc harrow which cuts the surface three or four inches deep. After this second crop of wheat is taken off, the ground is again fallowed the following season, hence the farmer with three hundred acres of land crops only 200 acres each year, the other hundred being given up to summer-fallow. As a result of such treatment, the farmer has one hundred acres of land every season in the very best condition for growing wheat, which can be sown very early in the spring and in this land much of the mosture of the previous season is retained. The one hundred acres of crop which he has sown on stubble does not give him nearly as large a return as the summer-fallowed land, usually twenty to twenty-five bushels per acre when the summer-fallow gives thirty to thirty-five bushels, but the expense of preparing for this crop is small. Thus far, this method of treating the land has given the best results; there are some objections to summer-fallow, there is no doubt that a bare fallow is more or less wasteful of the fertility of the soil, but this seems to be the only way in which weeds can be subdued thoroughly and by which the moisture in the land can be increased. Experiments have been in progress at Indian Head and Brandon for many years with the object of substituting a leguminous crop such as clover, peas, or vetches for the bare summer-fallow, but these efforts have not yet been very successful. Up to the present time, notwithstanding that the process of summer-fallowing is somewhat wasteful, it is recommended as the best plan thus far devised to obtain a succession of good crops. The Indian Head Farm has produced remarkably large crops for the last twenty years, and this district, under the stimulus of the example of the Experimental Farm, has become one of the best wheat-growing localities in the Northwest. The average yield of the fourteen varieties of wheat under trial last year was nearly forty bushels per acre, while oats gave over eighty bushels. Tests are made each year with all sorts of promising crops, the results of which are published in the annual report of the Experimental Farms. This Farm is visited and the crops examined by a large number of farmers each season. The benefits conferred on the farmers of the Canadian Northwest by the demonstrations made have been very great.

A large number of fruits have been tested and all the small fruits have been found quite hardy, but most of the larger fruits have proved to be tender. Many varieties of ornamental trees and shrubs have been introduced and about 200 of these have been found hardy, thus giving the farmer a large amount of material from which to select, in his efforts to improve and beautify his surroundings.

EXPERIMENTAL FARM, ROSTHERN, SASK.

This Farm has been recently established to serve the purposes of northern Saskatchewan. It has been located near Rosthern, 1,857 miles west of Ottawa, and less

than a mile from the railway station. The area of land secured here is about 155 acres, nearly all of which has been under cultivation. It is not proposed to conduct experiments with stock on this farm but to test all promising farm crops likely to succeed in the district, and to conduct experiments looking to a proper rotation of crops and to adopt the best methods of preparing the land. Experiments will be conducted with small fruits such as currants, gooseberries, raspberries and strawberries, also with such varieties of apples as are likely to succeed in that climate. It is proposed to test also a number of varieties of forest and ornamental trees, shrubs and flowers with the object of making this Farm an attractive spot and at the same time conveying to the farmers information as to the varieties which are likely to succeed with them. Meteorological observations will be taken regularly and farmers all through that district will be encouraged to visit the Farm and inspect the various lines of experimental work carried on.

EXPERIMENTAL FARM, LETHBRIDGE, ALTA.

A site in the neighbourhood of Lethbridge has been chosen for the Experimental Farm for southern Alberta. It consists of 400 acres of land and is situated one mile east of the city limits, 107 miles south of Indian Head, 2,067 miles west of Ottawa.

About 100 acres of this land is irrigable and the remaining 300 acres non-irrigable, so that experiments can be conducted with irrigation and also under dry-farming conditions. The soil of this farm is quite uniform, being a dark-gray coloured loam. Suitable buildings have been erected and a considerable area of land was under crop last year, 155 acres having been broken, of which 47 acres were in the irrigated portion. Many experiments were conducted with winter wheat on the non-irrigated land, and very good crops were secured, averaging for the greater part about 40 bushels per acre. Many experiments were conducted in 1908 on irrigated and non-irrigated land with spring wheat, oats, barley, peas, Indian corn, turnips, mangels, sugar beets and potatoes, and the results given in the annual report of the Farm. Much useful information is being acquired in this way regarding the crops of this district. Alfalfa, grown from seed obtained from different sources, is succeeding well in that locality and heavy crops have been had.

A large quantity of trees and shrubs have been planted in shelter belts and on the grounds, especially about the buildings. Orchards of cross-bred and Russian seedling apples of the hardiest sorts have been set out and plantations made of many different sorts of small fruits.

EXPERIMENTAL FARM, LACOMBE, ALTA.

An Experimental Farm has also been chosen for central Alberta within a mile of the town of Lacombe, which is 2,253 miles west of Ottawa and 78 miles south of Edmonton. It is in the centre of a large farming and stock district. There experiments are being carried on with many different sorts of grasses, clovers and fodder plants, special attention being paid to alfalfa, clover and timothy. The experiments conducted on the uniform trial plots of the most important farm crops are in progress here also. Lacombe is a railway centre where farmers from considerable distances can conveniently visit the Farm and gain information as to the results obtained from the many different lines of work conducted. The soil of this farm fairly represents the soil of the district, and in area contains about 160 acres. It is admirably located in full view of the passing trains and within a mile of the railway station. Suitable buildings have been erected on this site and active work has been carried on for the past two years. An extensive assortment, comprising several thousand specimens of forest and ornamental trees, with fruit trees, shrubs and small fruits have been planted on this farm to ascertain what varieties will be hardy and useful here.

EXPERIMENTAL FARM, AGASSIZ, B.C.

The Experimental Farm for the coast climate of British Columbia was established in 1889 at Agassiz, 2,711 miles west of Ottawa and 70 miles east of Vancouver. In this Farm there are about 325 acres of valley land and over 700 acres of mountain land which has been attached to the Experimental Farm so as to preserve the fine timber growing on the mountains in rear of the Farm from fire. These mountains rise to a height of about twelve hundred feet. The land in the valley is somewhat variable but most of it is very suitable for growing fruit, for which this Farm seems fairly well adapted. While the uniform trial plots, which cover experiments with all the more important farm crops, are conducted here as at the other Farms, the other part of the land has been devoted to the testing of different varieties of fruit, such as apples, pears, plums and cherries. In apples alone more than 1,200 named varieties have been tested, embracing nearly every sort of apple obtainable in all countries where apples are grown. Orchards containing a large number of the other sorts of large fruits have also been established. As these have borne fruit, the habits of the trees and the quality of the fruit have been described and thus a volume of useful records has been accumulated. Where a variety of fruit has proven valuable, it has been retained, but all the inferior sorts have been rooted up as soon as their inferiority was sufficiently established. In this way, much useful information on the question of varieties, as to their value, also as to their adaptablity to the climatic and other conditions prevailing at Agassiz has been obtained. In the prosecution of this work, some varieties of fruit have been found to possess unusual quality and great merit and these have been added to the list specially suited for cultivation in the coast climate of British Columbia. As the great work of testing varieties is now overtaken, commercial orchards have been established within the past three or four years consisting only of the finest varieties, of which twelve trees of each sort are planted. The fruits from these trees will be marketed and the proceeds of the crops made known. Orchards have also been established on the sides of the mountain in rear of the Farm at varying heights from about 200 to 1,100 feet, and thus it has been demonstrated that much land of this character, unsuited for farm crops, may be advantageously devoted to fruit-growing. Experiments have been also conducted with many different sorts of vegetables and small fruits, which have succeeded well here. An orchard of nut trees has also been established, consisting chiefly of different varieties of walnuts and chestnuts, most of which have now been bearing fruit for some years. These nuts are saved and distributed to farmers for planting, and in this way small groves have been established in many parts of that province.

The climate is very favourable for the growth of trees of many kinds. Forest plantations of valuable sorts of timber trees have been made and many groups of ornamental trees valuable for the decoration of lawns and grounds have been planted, and thus an example set which has been freely copied.

SMALLER EXPERIMENTAL STATIONS.

In addition to the nine Experimental Farms already referred to, there are three smaller stations, on farms occupied by settlers, where a portion only of the land has been rented for experimental purposes. One of such stations has been established near Kamloops, a very dry district, 2,527 miles west of Ottawa, where ten acres have been secured from Mr. E. W. Calhoun, with the object of growing cereals under dry-farming conditions. The land was ploughed and got into condition early this season and about two acres of winter wheat was recently sown. The remainder of the land will be occupied in the spring with other important farm crops.

A Second Station has been obtained near the southern end of Lake Abitibi in Quebec, near the Ontario line adjacent to the Grand Trunk Pacific railway. Five

acres of land is supplied there on a farm belonging to Mr. Frank Moberley. Winter wheat tested in that neighbourhood last year produced fine samples, and, this season, a number of varieties of spring grain have been sown. Experiments are also being tried in that locality with fodder plants and fruits, including a few young apple trees. As yet, scarcely anything is known of the possibilities of agriculture in that locality.

A Third Station has been secured at Fort Vermilion on the Peace River, 3,030 miles northwest of Ottawa and about 700 miles north of Edmonton by mail route, where five acres of land in a good state of cultivation have been obtained from Mr. Robert Jones, one of the older settlers at that point, and his services have been secured for carrying on the experiments. The arrangements for carrying the mails in that remote district seem somewhat primitive; the trips are made once a month and the 400 miles of roads over which the mail is carried are said to be very bad. On this account, the mail bag containing the seeds for experimental work, carefully packed and sealed and forwarded early in May, was left somewhere by the roadside on the way and picked up on the next trip a month later. Thus the seeds did not reach Fort Vermilion until June, when it was too late to use them and they were held over to be sown in the spring of 1909. In the absence of material for his experimental work, Mr. Jones gave much of his time that season to the examination of the crops grown by farmers in that district, and obtained samples of some of the cereals which were forwarded to Ottawa with the names of the growers. Mr. Jones thinks he is quite safe in estimating the wheat crop of 1908 in the Fort Vermilion district at 35,000 bushels, with an average yield of 24 bushels to the acre. He also estimates barley at 5,000 bushels, with an average yield of 60 bushels per acre, and the crop of oats at about 4,000 bushels.

The experimental plots of turnips gave a crop of over 16 tons to the acre, mangels 15 tons, and white carrots 12½ tons to the acre.

The hardy cross-bred apple trees produced at Ottawa, also some hardy Russian sorts, which were sent to Fort Vermilion in the spring of 1907, survived the winter of 1907-8 and made good growth during 1908, some of them as much as two feet. Some plum trees sent at the same time also made strong growth. Mr. Jones, writing on the 15th of October, says: 'Although most of our native trees are stripped of their foliage by frost, the leaves of the apple and plum trees are quite green yet.'

About 25 varieties of black, white and red currants and three different sorts of raspberries all survived the winter of 1907, which was reported as very severe. More than 50 hardy sorts of trees and shrubs also survived the winter and are reported as doing well.

Writing on August 29, 1908, Mr. Jones says: 'My garden vegetables are promising large yields; some of my carrots measure three inches in diameter and I have cauliflowers which weigh ten pounds each, also tomatoes of good size which are almost ripe now. The yield of potatoes will be large also; the earliest ones were ready for the table July 13.'

The samples of wheat received from Fort Vermilion were very fine and well-matured and unusually heavy. There were five samples in all, and their dates of sowing and harvesting were as follows:—

Variety.	Date of Sowing.	When Ripe.	When Cut.	Weight per Bushel.
				Lbs.
Preston	May 6	August 10	August 22	64¼
Ladoga	April 31		September 5	64
Ladoga	May 4	August 17	August 21	64
Early Riga	April 21		" 21	63
Riga	May 9		" 29	64¼

No samples of Red Fife could be obtained. All the varieties grown here are earlier than Red Fife and hence are preferred. These varieties have all been grown from samples sent to settlers in years past from the Experimental Farms.

Two samples of oats were received, one of Banner which weighed 41½ lbs. per bushel, and one unnamed which weighed 42 lbs. per bushel. Banner was sown May 16 and was ripe August 24. One sample of barley was received, unnamed. This was sown May 16 and was cut August 12 and weighed 49½ lbs. per bushel. There was also one sample of peas sown May 3 and harvested August 12, weighing 64 lbs. to the bushel.

From the dates of sowing and ripening, the absence of injury from frost, and the weights of the samples of grain sent, it is evident that the season of 1908 was quite as favourable for crop-growing at Fort Vermilion, as it was in many parts of Alberta further south.

From recent letters the following information has been obtained. Writing on June 28, 1908, Mr. Jones says: 'Everything on the Experimental Farm is looking well. The different varieties of wheat are now eighteen inches high, Preston being in the lead. Lettuce and radishes, sown on May 20, were ready for use June 9. Squash, melons and cucumbers were set back very much by frost on June 3, but are picking up again now. The crops in general are looking first-rate. Of the apple trees sent, 36 are growing well. From the list of ornamental trees and shrubs, the following have already bloomed:—

Caragana frutescens..	June 14,	Bloom.
Caragana pygmaeus..	" 18	"
Lonicera Alpina..	" 14	"
Lonicera Fenzlei..	" 14	"
Lonicera virginalis alba..	" 13	"
Lonicera mundeniensis..	" 12	"
Euonymus linearis..	Budded June 7,	in bloom ever since.
Ribes aureum..	June 10,	Bloom.
Lilac Chas. X..	" 1	"
Syringa villosa..	" 20	"
Spiraea arguta..	" 8	"

Of raspberries, I have about forty plants each of Heebner and Herbert, and they are doing well, also 150 plants of strawberries. Currants are doing remarkably well. The different varieties of alfalfa which I sowed on May 8 are five inches high, and in a few days I shall be giving it the first cutting. I had sufficient Brome grass seed to sow an acre. (A sample was inclosed in his letter measuring over two feet in height.) The different varieties of potatoes planted May 18 and 19 are in full bloom now.'

In the last letter, received July 24, 1909, he says: 'I cut my alfalfa on July 8, and from all the plots obtained about 1½ tons. Everything is progressing most favourably; all the wheats were fully headed on July 10, and at present are about 3 feet 6 inches in height. The barley and oats are also very well advanced and there is every prospect of a good yield. Under separate cover, I am sending you a sample of strawberries. (These came duly to hand and were of good size.)

Garden peas, sown May 19, were large enough for table use on July 20. Flower seeds, which were sown after everything else was planted, are just coming into bloom; among these may be mentioned California Poppy, Candytuft, Pansies, Sweet Peas, Mignonette and Phlox Drummondi. The apple trees and ornamental shrubs are doing very well. Indian corn is doing very well, some of it is now three feet high.'

I have dwelt in some detail on the progress made at this last station on account of the interest attached to a locality so far distant and about which so little is known, for which, I trust, I shall be excused.

SPECIAL EXPERIMENTS WITH FERTILIZERS.

(With final notes.)

In the Annual Report of the Experimental Farms for 1893, details were given, on pages 8 to 24, of the results of a series of tests which had then been carried on for some years, on plots of one-tenth acre each, with the object of gaining information regarding the effects which follow the application of certain fertilizers and combinations of fertilizers on the more important farm crops.

These experiments have been continued, and a summary of the results obtained has been given each year, by taking the average yield of crops from the beginning of the test, adding the results for the current year, and then giving the average yield for the full time. These tests were undertaken on virgin soil, on a piece of land which was cleared for the purpose. For particulars regarding the clearing and preparing of the land for crop in 1887-8 and its subsequent treatment, the reader is referred to the earlier issues of this report.

In 1888, when the experiments under discussion were begun, little was definitely known in Canada of the action of various materials in increasing fertility of soil and it was with a view of securing information on the subject that these tests were made. The plots were never intended to serve as models such as a farmer could copy to advantage in his general practice. On the contrary, to gain the information desired it has been found necessary to use some fertilizers in unusual quantities and in other instances to more or less exhaust the soil by a succession of crops of the same sort, practices which, in ordinary farming, would be extravagant or detrimental; also, since the character of the season has a more immediate effect on the crop than the fertilizer applied, it was desirable to gain fuller light on this subject by extending the experiment over a long period so that averages of results might be obtained for good and bad years.

VALUABLE INFORMATION GAINED.

From this long-continued series of tests some useful information has been gained.

These trials have shown that barnyard manure can be most economically used in the fresh or unrotted condition; that fresh manure is equal, ton for ton, in crop-producing power to rotted manure, which, other experiments have shown, loses during the process of rotting about 60 per cent of its weight. In view of the vast importance of making the best possible use of barnyard manure, it is difficult to estimate the value of this one item of information.

In the second group, the value of clover as a fertilizer has been clearly shown. In addition to the nitrogen gathered from the air, it adds to the mineral plant foods available by collecting them from depths not reached by the shallower root-systems of other farm crops. It serves as a catch crop, retaining fertilizing material brought down by the rain and snow, much of which would otherwise be lost. It also supplies the land with a large addition of humus and results in deepening and mellowing the soil.

When these experiments were planned, the opinion was very generally held that untreated mineral phosphate, if very finely ground, was a valuable fertilizer, which gradually gave up its phosphoric acid for the promotion of plant growth. Many years' experience has shown that mineral phosphate, untreated, is practically of no value as a fertilizer.

Sulphate of iron, which, at the time these tests were begun, was highly recommended as a means of producing increased crops, has also proven to be of very little value for this purpose.

Common salt, which has long had a reputation for its value as a fertilizer for barley, with many farmers, while others disbelieved in its efficacy, has been shown to be a valuable agent for producing an increased crop of that grain, while it is of much less use when applied to crops of spring wheat or oats. Land plaster or gypsum has also proved to be of some value as a fertilizer for barley, while of very little service for wheat or oats. Some light has also been thrown on the relative usefulness of single and combined fertilizers.

CHANGES MADE IN THE EXPERIMENTS.

After ten years' experience had demonstrated that finely-ground, untreated mineral phosphate was of no value as a fertilizer, its use was discontinued in 1898. Prior to this, it had been used in each set of plots in Nos. 4, 5, 6, 7 and 8, in all the different series of plots, excepting roots. In 1898 and 1899, similar weights of the Thomas' phosphate were used in place of the mineral phosphate, excepting in plot 6 in each series. In this plot the Thomas' phosphate was used in 1898 only.

After constant cropping for ten or eleven years, it was found that the soil on those plots to which no barnyard manure had been applied, was much depleted of humus, hence its power of holding moisture had been lessened, and the conditions for plant growth, apart from the question of plant food, had on this account become less favourable. In 1899, the experiments were modified and an effort made to restore some proportion of the humus and at the same time gain further information as to the value of clover as a collector of plant food. In the spring of that year, ten pounds of red clover seed per acre was sown with the grain on all the plots of wheat, barley and oats. The young clover plants made rapid growth, and by the middle of October there was a thick mat of foliage, varying in height and density on the different plots, which was ploughed under. No barnyard manure was applied on plots 1 and 2 in each series from 1898 to 1905.

In 1900 all the fertilizers on all the plots were discontinued, and from then to 1905 the same crops were grown on all these plots from year to year without fertilizers, sowing clover with the grain each season. In this way some additional information has been gained as to the value of clover as a collector of plant-food, and also as to the unexhausted values of the different fertilizers which had been used on these plots since the experiments were begun. In 1905-1909 inclusive, all the fertilizers were again used as in 1898.

SPECIAL TREATMENT OF PLOTS OF INDIAN CORN AND ROOTS.

As it was not practicable to sow clover with the Indian corn and root crops, the sowing of these latter crops was discontinued in the spring of 1900 and clover sown in their places, in the proportion of 12 pounds per acre. The clover on these plots made strong growth, so strong as to necessitate twice cutting during the season, the cut clover being left on the ground in each case to decay and add to the fertility of the soil. The clover was left over for further growth in the spring of 1901, and ploughed under for the roots about May 10, and for corn, about the middle of that month. Then roots and Indian corn were again sown. In 1902 also, crops of Indian corn and roots were grown on these plots. In 1903 the land was again devoted to clover and was in Indian corn and roots again in 1904 and each year since.

WHEAT PLOTS.

The seed sown on each of these plots from the beginning has been in the proportion of about $1\frac{1}{2}$ bushels per acre, excepting in 1894; and the varieties used were as follows:—In 1888 to 1891, White Russian, and in 1892-3, Campbell's White Chaff. In 1894, Rio Grande was used, and from 1895 to 1909, inclusive, Red Fife. In 1909, the Red Fife was sown May 20 and was ripe September 8.

TABLE I.—EXPERIMENTS WITH FERTILIZERS ON PLOTS OF WHEAT.

Number of Plot.	Fertilizers applied each year from 1888 to 1898 or 1899. No fertilizers used from that time to 1905. Clover sown in 1899 and each year after to 1905 with the grain and ploughed under in the autumn. From 1905-9 fertilizer again applied as in 1898. Clover discontinued.	Average Yield for Twenty-one Years. Yield of Grain. Per acre.	Average Yield for Twenty-one Years. Yield of Straw. Per acre	22nd Season, 1909. Variety, Red Fife. Yield of Grain. Per acre.	22nd Season, 1909. Variety, Red Fife. Yield of Straw. Per acre	Average Yield for Twenty-two Years. Yield of Grain. Per acre.	Average Yield for Twenty-two Years. Yield of Straw. Per acre
		Bush. Lbs.	Lbs.	Bush. Lbs.	Lbs.	Bush. Lbs.	Lbs.
1	Barn-yard manure (mixed horse and cow manure), well rotted, 12 tons per acre in 1888; 15 tons per acre each year after to 1898 inclusive. No manure used from 1899 to 1905. From 1905-9, 15 tons per acre again used	21 $54\frac{10}{21}$	3679	14 40	2620	21 $34\frac{16}{22}$	3631
2	Barn-yard manure (mixed horse and cow-manure) fresh, 12 tons per acre in 1888; 15 tons per acre each year after to 1898 inclusive. No manure used from 1899 to 1905. From 1905-9, 15 tons per acre again used	22 $2\frac{16}{21}$	3708	15 20	2120	21 $44\frac{10}{22}$	3636
3	Unmanured from the beginning	11 $16\frac{14}{21}$	1806	4 0	680	10 $56\frac{15}{22}$	1755
4	Mineral phosphate, untreated, finely ground, 500 lbs. per acre, used each year from 1888 to 1897 inclusive. In 1898 and 1899 a similar weight of the Thomas' phosphate was used. No fertilizer used from 1900 to 1905. From 1905-9 Thomas phosphate again used as in 1899	12 15	1939	4 0	760	11 $52\frac{11}{22}$	1885
5	Mineral phosphate, untreated, finely ground, 500 lbs., nitrate of soda, 200 lbs. per acre used each year from 1888 to 1897 inclusive. In 1898 and 1899, 500 lbs. of the Thomas' phosphate were used in place of the mineral phosphate. No fertilizers used from 1900 to 1905. From 1905-9 fertilizer again used as in 1899	13 $13\frac{2}{21}$	2505	8 40	1180	13 $0\frac{15}{22}$	2445
6	Barn-yard manure, partly rotted and actively fermenting, six tons per acre; mineral phosphate, untreated, finely ground, 500 lbs. per acre, composted together, intimately mixed and allowed to heat for several days before using, applied each year from 1888 to 1897 inclusive. In 1898, 500 lbs. of Thomas' phosphate were used in place of the mineral phosphate. No fertilizer used from 1899 to 1905. From 1905-9 fertilizer again used as in 1898	19 $13\frac{5}{21}$	3121	9 40	1520	18 $47\frac{4}{22}$	3048
7	Mineral phosphate, untreated, finely ground, 500 lbs.; nitrate of soda, 200 lbs.; wood ashes, unleached, 1,000 lbs. per acre, used each year from 1888 to 1897 inclusive. In 1898 and 1899, 500 lbs. of the Thomas' phosphate were used in place of the mineral phosphate. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as in 1899	13 51	2522	8 0	1260	13 $35\frac{1}{22}$	2465

TABLE I.—EXPERIMENTS WITH FERTILIZERS ON PLOTS OF WHEAT—*Concluded.*

No. of Plot.	Fertilizers applied each year from 1888 to 1898 or 1899. No fertilizer used from that time to 1905. Clover sown in 1899 and each year after to 1905 with the grain and ploughed under in the autumn. From 1905-9 fertilizer again applied as in 1898. Clover discontinued.	Average Yield for twenty-one Years.			22nd Season, 1909 Variety, Red Fife.			Average Yield for Twenty-two Years.		
		Yield of Grain.		Yield of Straw.	Yield of Grain.		Yield of Straw.	Yield of Grain.		Yield of Straw.
		Per acre.		Per acre	Per acre.		Per acre	Per acre.		Per acre
		Bush.	lbs.	Lbs.	Bush.	lbs.	Lbs.	Bush.	lbs.	Lbs.
8	Mineral phosphate, untreated, finely ground, 500 lbs.; wood ashes, unleached, 1,500 lbs. per acre, used each year from 1888 to 1897 inclusive. In 1898 and 1899, 500 lbs. of the Thomas' phosphate were used in place of the mineral phosphate. No fertilizers used from 1900 to 1905. From 1905-9 fertilizers again used as in 1899...	11	$43\frac{17}{21}$	2107	4	50	750	11	25	2045
9	Mineral superphosphate, No. 1, 500 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as in 1899........	12	$18\frac{5}{21}$	1893	4	40	600	11	$57\frac{9}{22}$	1834
10	Mineral superphosphate, No. 1, 350 lbs., nitrate of soda, 200 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as in 1899...	13	$16\frac{20}{21}$	2720		30	1050	13	$1\frac{4}{22}$	2644
11	Mineral superphosphate, No. 1, 350 lbs., nitrate of soda, 200 lbs., wood ashes, unleached, 1,500 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as in 1899..........	14	$11\frac{5}{21}$	2725	7	50	1170	13	$53\frac{20}{22}$	2655
12	Unmanured from the beginning.....	10	$10\frac{20}{21}$	1764	3	0	560	9	$51\frac{8}{22}$	1710
13	Bone, finely ground, 500 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 bone again used as at first........	12	$27\frac{16}{21}$	1991	5	0	700	12	$7\frac{9}{22}$	1933
14	Bone, finely ground, 500 lbs., wood ashes unleached, 1,500 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first....	15	$14\frac{16}{21}$	2506	11	20	1220	15	$4\frac{2}{22}$	2448
15	Nitrate of soda, 200 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first....	13	$55\frac{2}{21}$	2351	8	10	960	13	$39\frac{9}{22}$	2288
16	Muriate of potash, 150 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first....	15	$1\frac{2}{21}$	2176	8	0	1010	14	$41\frac{21}{22}$	2123
17	Sulphate of ammonia, 300 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first....	12	$41\frac{6}{21}$	2327	6	10	1440	12	$23\frac{11}{22}$	2287
18	Sulphate of iron, 60 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first...... ...	12	$23\frac{16}{21}$	1928	6	0	680	12	$6\frac{7}{22}$	1871
19	Common salt (Sodium chloride), 300 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first........	13	19	1620	4	40	560	12	$55\frac{9}{22}$	1572
20	Land plaster or gypsum (Calcium sulphate), 300 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first........	12	$35\frac{8}{21}$	1873	4	40	670	12	$13\frac{17}{22}$	1818
21	Mineral superphosphate, 500 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first..	12	$56\frac{9}{21}$	1857	5	20	720	12	$35\frac{15}{22}$	1806

BARLEY PLOTS.

The quantity of seed sown per acre on the barley plots was about 2 bushels from 1889 to 1891, $1\frac{1}{2}$ bushels in 1892 and 1893, and 2 bushels from 1894 to 1909, inclusive. Two-rowed barley was used for seed throughout until 1902, when Mensury, a six-rowed sort, was tried. The varieties used were as follows: 1889 to 1891, Saale; 1892, Goldthorpe; 1893, Duckbill; and in 1894 to 1901, Canadian Thorpe, a selected form of the Duckbill. Since 1902 Mensury has been sown. In 1909 it was sown May 26, and was harvested on August 25.

TABLE II.—EXPERIMENTS WITH FERTILIZERS ON PLOTS OF BARLEY.

No. of Plot.	Fertilizers applied each year from 1889 to 1898 or 1899. No fertilizer used from that time to 1905. Clover sown in 1899 and each year after to 1905 with the grain and ploughed under in the autumn. From 1905-9 fertilizer again applied as in 1898. Clover discontinued.	Average Yield for Twenty Years.			21st Season, 1909, Variety, Mensury.			Average Yield for Twenty-one Years.		
		Yield of Grain.		Yield of Straw.	Yield of Grain.		Yield of Straw.	Yield of Grain.		Yield of Straw.
		Per acre.		Per acre	Per acre.		Per acre	Per acre.		Per acre
		Bush.	lbs.	Lbs.	Bush.	lbs.	Lbs.	Bush.	lbs.	Lbs.
1	Barn-yard manure, well rotted, 15 tons per acre each year to 1898, inclusive. No manure used from 1899 to 1905. From 1905-9, 15 tons per acre again used......	36	$32\frac{12}{20}$	2917	21	42	1710	35	$46\frac{16}{21}$	2860
2	Barn-yard manure, fresh, 15 tons per acre each year to 1898, inclusive. No manure used from 1899 to 1905. From 1905-9, 15 tons per acre again used................	37	10	2981	22	44	1900	35	$26\frac{4}{21}$	2930
3	Unmanured from the beginning	14	$45\frac{11}{20}$	1427	8	16	740	14	$30\frac{9}{21}$	1394
4	Mineral phosphate, untreated, finely ground 500 lbs. per acre, used each year from 1888 to 1897, inclusive. In 1898 and 1899 a similar weight of the Thomas' phosphate was used. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as in 1899	16	$29\frac{10}{20}$	1505	9	28	520	16	$13\frac{9}{21}$	1458
5	Mineral phosphate, untreated, finely ground 500 lbs., nitrate of soda, 200 lbs. per acre, used each year from 1888 to 1897, inclusive. In 1898 and 1899, 500 lbs. of the Thomas' phosphate were used in place of the mineral phosphate. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as in 1899...............	22	$40\frac{2}{20}$	2150	14	8	1360	21	$35\frac{19}{21}$	2112
6	Barn-yard manure, partly rotted and actively fermenting, 6 tons per acre, mineral phosphate, untreated, finely ground 500 lbs. per acre, composted together, intimately mixed and allowed to heat for several days before using, applied each year from 1888 to 1897, inclusive. In 1898, 500 lbs. of the Thomas' phosphate were used in place of the mineral phosphate. No fertilizer used from 1900 to 1995. From 1905-9 fertilizer again used as in 1898.......	30	$22\frac{5}{20}$	2373	14	28	1040	29	$33\frac{20}{21}$	2310
7	Mineral phosphate, untreated, finely ground 500 lbs., nitrate of soda, 200 lbs., wood ashes, unleached, 1,000 lbs. per acre, used each year from 1888 to 1897, inclusive. In 1898 and 1899, 500 lbs. of the Thomas' phosphate was used in place of the mineral phosphate. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer used as in 1899............................	28	$37\frac{4}{20}$	2373	16	12	1260	28	$8\frac{17}{21}$	2320

TABLE II.—EXPERIMENTS WITH FERTILIZERS ON PLOTS OF BARLEY.—*Concluded.*

No. of Plot.	Fertilizers applied each year from 1889 to 1898 or 1899. No fertilizer used from that time to 1905. Clover sown in 1899, and each year after to 1905 with the grain and ploughed under in the autumn. From 1905-9 fertilizer again applied as in 1898. Clover discontinued.	Average Yield for Twenty Years. Yield of Grain. Per acre. Bush.	lbs.	Average Yield for Twenty Years. Yield of Straw. Per acre. Lbs.	21st Season, 1909. Variety, Mensury. Yield of Grain. Per acre. Bush.	lbs	21st Season, 1909. Yield of Straw. Per acre. Lbs.	Average Yield for Twenty-one Years. Yield of Grain. Per acre. Bush.	lbs.	Average Yield for Twenty-one Years. Yield of Straw. Per acre. Lbs.
8	Mineral phosphate, untreated, finely ground, 500 lbs., wood ashes, unleached, 1,500 lbs. per acre, used each year from 1888 to 1897, inclusive. In 1898 and 1899, 500 lbs. of the Thomas' phosphate were used in place of the mineral phosphate. No fertilizer used from 1900 to 1905. From 1905-09 fertilizer again used as in 1899..	23	$32\frac{19}{21}$	1829	14	28	600	25	$12\frac{3}{21}$	1771
9	Mineral superphosphate No. 1, 500 lbs. per acre used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as in 1899.	22	$18\frac{1}{20}$	1693	8	16	900	21	$33\frac{20}{21}$	1656
10	Mineral superphosphate, No. 1, 350 lbs., nitrate of soda, 200 lbs. per acre. used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as in 1899....	28	35	2285	13	16	1020	27	$47\frac{17}{21}$	2225
11	Mineral superphosphate, No. 1, 350 lbs., nitrate of soda, 200 lbs., wood ashes, unleached, 1,500 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as in 1899....	28	$25\frac{10}{20}$	2371	19	8	1620	28	$4\frac{2}{21}$	2335
12	Unmanured from the beginning	14	$32\frac{3}{20}$	1195	4	8	400	14	$8\frac{3}{21}$	1157
13	Bone, finely ground, 500 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 bone again used as at first.......	16	$23\frac{7}{20}$	1327	9	8	640	16	$6\frac{13}{21}$	1294
14	Bone finely ground, 500 lbs., wood ashes, unleached, 1,500 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first....	24	$41\frac{16}{20}$	2036	21	22	1000	24	34	1987
15	Nitrate of soda, 200 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first....	22	$1\frac{15}{20}$	2062	12	24	860	21	$27\frac{20}{21}$	2005
16	Muriate of potash, 150 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first....	23	$0\frac{17}{20}$	1714	17	4	810	22	$35\frac{6}{21}$	1671
17	Sulphate of ammonia, 300 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first....	19	$5\frac{7}{20}$	1760	8	36	640	18	$29\frac{14}{21}$	1707
18	Sulphate of iron, 60 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905 From 1905-9 fertilizer again used as at first...	19	$25\frac{7}{20}$	1505	10	10	510	19	$4\frac{1}{21}$	1458
19	Common salt (Sodium chloride) 300 lbs. per acre used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first...........	27	$37\frac{5}{20}$	1810	11	32	1040	27	$0\frac{9}{21}$	1774
20	Land plaster or gypsum (calcium sulphate), 300 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first.....	20	$47\frac{18}{20}$	1467	8	36	680	20	$19\frac{19}{21}$	1430
21	Mineral superphosphate, 500 lbs. per acre. used each year from 1889, to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first..............................	21	$23\frac{11}{20}$	1614	9	28	680	20	$44\frac{7}{21}$	1570

OAT PLOTS.

The quantity of seed sown per acre on the oat plots was about 2 bushels in 1889 and 1890; 1½ bushels from 1891 to 1893, and 2 bushels from 1894 to 1909, inclusive. The varieties used were as follows: In 1889, Early English; in 1890 to 1893, Prize Cluster; and from 1894 to 1909, inclusive, the Banner. In 1909, Banner was sown May 26 and the plots were harvested August 31.

TABLE III.—EXPERIMENTS WITH FERTILIZERS ON PLOTS OF OATS.

No. of Plot.	Fertilizers applied each year from 1889 to 1898 or 1899. No fertilizer used from that time to 1905. Clover sown in 1899 and each year after to 1905 with the grain and ploughed under in the autumn. From 1905-9 fertilizers again applied as in 1898. Clover discontinued.	Average Yield for Twenty Years.			21st Season, 1909. Variety, Banner.			Average Yield for Twenty-one Years.		
		Yield of Grain.		Yield of Straw.	Yield of Grain.		Yield of Straw.	Yield of Grain.		Yield of Straw.
		Per acre.		Per acre	Per acre.		Per acre	Per acre.		Per acre
		Bush.	lbs.	Lbs.	Bush.	lbs.	Lbs.	Bush.	lbs.	Lbs.
1	Barn-yard manure, well rotted, 15 tons per acre each year to 1898, inclusive. No manure used from 1899 to 1905. From 1905-9, 15 tons per acre were again used.	51	$30\frac{5}{20}$	3067	45	30	2400	51	$20\frac{11}{21}$	3036
2	Barn-yard manure, fresh, 15 tons per acre each year to 1898, inclusive. No manure used from 1899 to 1905. From 1905-9, 15 tons per acre were again used......	54	$24\frac{14}{20}$	3240	46	16	1860	54	$11\frac{7}{21}$	3174
3	Unmanured from the beginning	34	$0\frac{5}{20}$	1646	14	14	820	33	3	1607
4	Mineral phosphate, untreated, finely ground, 500 lbs. per acre, used each year from 1888 to 1897, inclusive. In 1898 and 1899 a similar weight of the Thomas' phosphate was used. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as in 1899....................	36	$4\frac{16}{20}$	1874	28	8	1100	35	26	1837
5	Mineral phosphate, untreated, finely ground, 500 lbs., nitrate of soda, 200 lbs. per acre, used each year from 1888 to 1897, inclusive. In 1898 and 1899, 500 lbs. of the Thomas' phosphate were used in place of the mineral phosphate. No fertilizer used from 1909 to 1905. From 1905-9 fertilizers again used as in 1899...	47	25	2642	40	20	2240	47	$13\frac{9}{21}$	2623
6	Barn-yard manure, partly rotted and actively fermenting, 6 tons per acre, mineral phosphate, untreated, finely ground, 500 lbs. per acre, composted together, intimately mixed and allowed to heat for several days before using, applied each year from 1888 to 1897, inclusive. In 1898 500 lbs. of Thomas' phosphate were used in place of the mineral phosphate. No fertilizer used from 1899 to 1905. From 1905 9, fertilizers again used as in 1898..	47	33	2682	41	6	2120	47	22	2656
7	Mineral phosphate, untreated, finely ground, 500 lbs., nitrate of soda, 200 lbs., wood ashes, unleached, 1,000 lbs. per acre, used each year from 1888 to 1897, inclusive. In 1898 and 1899, 500 lbs. of the Thomas' phosphate were used in place of the mineral phosphate. No fertilizer used from 1900 to 1905. From 1905-9 fertilizers again used as in 1899.........	47	$25\frac{13}{20}$	3002	41	6	2600	47	15	2983
8	Mineral phosphate, untreated, finely ground, 500 lbs., wood ashes, unleached, 1,500 lbs. per acre, used each year from 1888 to 1897, inclusive. In 1898 and 1899, 500 lbs. of Thomas' phosphate were used in place of the mineral phosphate. No fertilizer used from 1900 to 1905. From 1905-9 fertilizers again used as in 1899.	42	$30\frac{15}{20}$	2437	30	6	940	42	$11\frac{16}{21}$	2366

TABLE III.—EXPERIMENTS WITH FERTILIZERS ON PLOTS OF OATS—*Concluded.*

No. of Plot.	Fertilizers applied each year, from 1889 to 1898 or 1899. No fertilizer used from that time to 1905. Clover sown in 1899 and each year after to 1905 with the grain and ploughed under in the autumn. From 1905-9 fertilizers again applied as in 1898. Clover discontinued.	Average Yield for Twenty Years. Yield of Grain. Per acre.		Average Yield for Twenty Years. Yield of Straw. Per acre	21st Season, 1909. Variety, Banner. Yield of Grain. Per acre.		21st Season, 1909. Variety, Banner. Yield of Straw. Per acre	Average Yield for Twenty-one Years. Yield of Grain. Per acre.		Average Yield for Twenty-one Years. Yield of Straw. Per acre
		Bush.	lbs.	Lbs.	Bush.	lbs.	Lbs.	Bush.	lbs.	Lbs.
9	Mineral superphosphate, No. 1, 500 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as in 1899	37	$18\frac{7}{20}$	1919	22	32	920	36	$28\frac{15}{21}$	1872
10	Mineral superphosphate, No. 1, 350 lbs. nitrate of soda, 200 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizers again used as in 1899	45	$31\frac{10}{20}$	2476	32	12	1660	45	$9\frac{11}{21}$	2437
11	Mineral superphosphate, No. 1, 350 lbs. nitrate of soda, 200 lbs., wood ashes, unleached, 1,500 lbs., per acre, used each year from 1888 to 1899, inclusive. No fertilizers used from 1900 to 1905. From 1905-9 fertilizers again used as in 1899	37	$16\frac{19}{20}$	2264	14	4	1520	36	$13\frac{3}{21}$	2229
12	Unmanured from the beginning	22	$25\frac{10}{20}$	1397	7	2	320	22	$0\frac{7}{21}$	1346
13	Bone, finely ground, 500 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 bone again used as at first	34	$8\frac{15}{20}$	1855	22	32	1580	33	$24\frac{9}{21}$	1842
14	Bone, finely ground, 500 lbs., wood ashes, unleached, 1,500 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizers used again as at first	39	$22\frac{6}{20}$	2193	27	22	1760	39	$2\frac{18}{21}$	2172
15	Nitrate of soda, 200 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first	45	$9\frac{8}{20}$	2564	28	8	1180	44	$15\frac{17}{21}$	2498
16	Muriate of potash, 150 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first	39	$15\frac{6}{20}$	2086	37	22	1280	39	$12\frac{7}{21}$	2048
17	Sulphate of ammonia, 300 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first	45	$25\frac{13}{20}$	2644	34	4	1280	45	$6\frac{17}{21}$	2579
18	Sulphate of iron, 60 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first	39	$12\frac{14}{20}$	1970	30	20	1120	38	$32\frac{10}{21}$	1930
19	Common salt (Sodium chloride), 300 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer used again as at first	39	$17\frac{5}{20}$	1960	31	26	1180	39	$4\frac{18}{21}$	1923
20	Land plaster or gypsum (Calcium sulphate), 300 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first	35	33	1969	27	22	1000	35	$19\frac{11}{21}$	1923
21	Mineral superphosphate, 500 lbs. per acre, used each year from 1889 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first	36	$20\frac{1}{20}$	1847	28	8	1200	35	$21\frac{10}{21}$	1816

The one-tenth acre plots of wheat, barley and oats had, by the end of 1903, become infested with several troublesome perennial weeds, hence it was thought best to sow only one-half of each plot with grain in 1904, devoting the other half to a hoed crop to clean the land. On this account, no clover was sown on any of the cereal plots in 1904, and one-half of each wheat plot was sown with mangels, one-half of each barley plot with potatoes, and one-half of each oat plot with carrots, computing the yields of grain from a one-twentieth acre plot in each case. Similar hoed crops were sown in 1905, 1906, 1907, 1908 and 1909, changing the position of the varieties from year to year.

INDIAN CORN PLOTS.

The experiments with the plots of Indian corn have been conducted with the object of obtaining the largest weight of well matured green fodder for the silo, and of having the corn so well advanced when cut, that the ears shall be, as far as is practicable, in the late milk or glazed condition. Each plot has been divided from the outset into two equal parts, on one of which—known as No. 1—one of the stronger-growing and somewhat later-ripening sorts has been tried, and on the other, marked No. 2, one of the earlier-maturing varieties. During the first four years, one of the Dent varieties was tested under No. 1. On the other half of the plot (No. 2) one of the Flint varieties was grown. For the first four years, the No. 1 series was planted in drills 3 feet apart, using about 24 pounds of seed to the acre and thinning the plants, when up, to 6 or 8 inches apart, and the No. 2 in hills 3 feet apart each way, with 4 or 5 kernels in a hill. During the past twelve years, both sorts have been grown in hills.

In 1900, no crop of Indian corn was grown on these plots, but red clover was sown in its place on May 5 in the proportion of 12 pounds per acre. This made a strong growth, was cut twice during the season and left on the ground to decay, so that when ploughed under, the land might get the full benefit of the clover crop. The clover was allowed to remain growing until May 20, 1901. It was then ploughed under about 6 inches deep, and harrowed well before the corn was planted. Clover was sown again in 1903, and ploughed under in May, 1904. Corn was planted in 1905, 1906, 1907, 1908 and 1909. In 1909 it was planted on June 1, and cut for ensilage September 21.

EXPERIMENTS WITH FERTILIZERS ON PLOTS OF INDIAN CORN, CUT GREEN FOR ENSILAGE.

No. of Plot.	Fertilizers applied each year from 1888 to 1898 or 1899. No fertilizer used from that time to 1905. Clover sown in 1900 in place of the corn and ploughed under in May, 1901, before the corn was planted. In 1903 clover was again sown and ploughed under in May, 1904. From 1905-9 fertilizers again applied as in 1898. Clover discontinued.	Average Yield for Seventeen Years.				18th Season, 1909.				Average Yield for Eighteen Years.			
		Plot No. 1—weight of green fodder.		Plot No. 2—weight of green fodder.		Plot No. 1—Selected Leaming, weight of green fodder.		Plot No. 2—Longfellow, weight of green fodder.		Plot No. 1—weight of green fodder.		Plot No. 2—weight of green fodder.	
		Per acre.		Per acre		Per acre.		Per acre		Per acre.		Per acre	
		Tons.	lbs.	Tons	lbs	Tons.	lbs.	Tons	lbs	Tons.	lbs.	Tons	lbs
1	Barn-yard manure (mixed horse and cow manure) well rotted, 12 tons per acre each year from 1888 to 1898 inclusive. No manure used from 1899 to 1905. From 1905-9 manure was again used as at first.	15	1801	12	1552	15	1620	10	1300	15	1791	12	1316
2	Barn-yard manure (mixed horse and cow-manure) fresh, 12 tous per acre each year from 1888 to 1898 inclusive. No manure used from 1899 to 1905. From 1905-9 manure was again used as at first........	15	15	11	921	10	1500	9	1800	14	1542	11	748
3	Unmanured from the beginning..........	6	407	4	1751	1	1880	1	1080	5	1933	4	1380

EXPERIMENTS WITH FERTILIZERS ON PLOTS OF INDIAN CORN—*Continued.*

No. of Plot.	Fertilizers applied each year from 1888 to 1898 or 1899. No fertilizer used from that time to 1905. Clover sown in 1900 in place of the corn and ploughed under in May, 1901, before the corn was planted. In 1903 clover was again sown and ploughed under in May, 1904. From 1905-9 fertilizers again applied as in 1898. Clover discontinued.	Average Yield for Seventeen Years.				18th Season, 1909.				Average Yield for Eighteen Years.			
		½ Plot No. 1—weight of green fodder.		½ Plot No. 2—weight of green fodder.		½ Plot No. 1—Selected Leaming, weight of green fodder.		½ Plot No. 2—Longfellow, weight of green fodder.		½ Plot No. 1—weight of green fodder.		½ Plot No. 2—weight of green fodder.	
		Per acre.		Per acre		Per acre.		Per acre		Per acre.		Per acre	
		Tons.	lbs.	Tons	lbs	Tons.	lbs.	Tons	lbs	Tons.	lbs.	Tons	lbs
4	Mineral phosphate, untreated, finely ground, 800 lbs. per acre, used each year from 1888 to 1897 inclusive. In 1898 and 1899 a similar weight of the Thomas' phosphate was used. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as in 1899.	7	1653	5	1070	3	520	3	180	7	1146	5	798
5	Mineral phosphate, untreated, finely ground, 800 lbs., nitrate of soda, 200 lbs. per acre, used each year from 1888 to 1897 inclusive. In 1898 and 1899, 800 lbs. of the Thomas' phosphate were used in place of the mineral phosphate. No fertilizer used from 1900 to 1905. From 1905-9 fertilizers again used as in 1899..	11	178	9	100	5	1260	6	920	10	1572	8	1812
6	Barn-yard manure, partly rotted and actively fermenting, 6 tons per acre, mineral phosphate, untreated, finely ground, 500 lbs. per acre, composted together, intimately mixed and allowed to heat for several days before using, applied each year from 1888 to 1897 inclusive. In 1898, 500 lbs. of Thomas' phosphate were used in place of the mineral phosphate. No fertilizer used from 1899 to 1905. From 1905-9 fertilizers again used as in 1898...	15	641	11	1314	9	1000	9	1000	14	1994	11	1074
7	Mineral phosphate, untreated, finely ground, 500 lbs., nitrate of soda, 200 lbs., wood ashes, unleached, 1,000 lbs. per acre, used each year from 1888 to 1897 inclusive. In 1898 and 1899, 500 lbs. of the Thomas' phosphate were used in place of the mineral phosphate. No fertilizers used from 1900 to 1905. From 1905-9 fertilizers again used as in 1899...	14	682	10	1664	9	220	9	1680	14	101	10	1554
8	Mineral phosphate, untreated, finely ground, 500 lbs., wood ashes, unleached, 1,500 lbs. per acre, used each year from 1888 to 1897 inclusive. In 1898 and 1899, 500 lbs. of the Thomas' phosphate were used in place of the mineral phosphate. No fertilizer used from 1900 to 1905. From 1905-9 fertilizers again used as in 1899...	11	1429	9	652	6	580	5	1140	11	826	9	235
9	Mineral superphosphate, No. 1,500 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as in 1899	10	1457	7	1654	5	1260	4	440	10	891	7	1253
10	Mineral superphosphate, No. 1, 350 lbs., nitrate of soda, 200 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizers again used as in 1899...	12	666	9	1597	5	1800	5	100	11	1951	9	1069
11	Mineral superphosphate, No. 1, 350 lbs., nitrate of soda, 200 lbs., wood ashes, unleached, 1,500 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizers again used as in 1899. .	15	410	11	1731	9	920	8	760	14	1772	11	1344

EXPERIMENTS WITH FERTILIZERS ON PLOTS OF INDIAN CORN—*Concluded.*

No. of Plot.	Fertilizers applied each year from 1888 to 1898 or 1899. No fertilizer used from that time to 1905. Clover sown in 1900 in place of the corn and ploughed under in May, 1901, before the corn was planted. In 1903 clover was again sown and ploughed under in May, 1904. From 1905-9 fertilizers again applied as in 1898. Clover discontinued.	Average Yield for Seventeen Years.		18th Season, 1909.		Average Yield for Eighteen Years.	
		½ Plot No. 1—weight of green fodder.	½ Plot No. 2—weight of green fodder.	½ Plot No. 1—Selected Leaming, weight of green fodder.	½ Plot No. 2—Longfellow, weight of green fodder.	½ Plot No. 1—weight of green fodder.	½ Plot No. 2—weight of green fodder.
		Per acre.	Per acre	Per acre.	Per acre	Per acre.	Per acre
		Tons. lbs.	Tons lbs	Tons. lbs.	Tons lbs	Tons. lbs.	Tons lbs
12	Unmanured from the beginning	10 240	8 783	5 800	3 640	9 1716	8 220
13	Bone, finely ground, 500 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 bone again used as at first.......	11 701	8 1918	4 240	3 860	10 1898	8 1304
14	Bone, finely ground, 500 lbs., wood ashes, unleached, 1,500 lbs., per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizers again used as at first ..	12 805	9 1609	6 1540	6 1380	12 179	9 1263
15	Nitrate of soda, 200 lbs. per acre, used each year from 1888 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first ...	11 42	9 76	5 300	4 1300	10 1390	8 1589
16	Sulphate of ammonia, 300 lbs. per acre, used each year from 1888 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first	11 1904	9 982	6 1640	4 1680	11 1334	9 465
17	Mineral superphosphate, No. 1, 600 lbs., muriate of potash, 200 lbs., sulphate of ammonia, 150 lbs. per acre, used each year from 1889 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizers again used as at first...	13 1	9 1732	8 240	6 740	12 1459	9 1344
18	Muriate of potash, 300 lbs. per acre used each year from 1889 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first ...	9 1910	7 1165	5 140	5 360	9 1436	7 898
19	Double sulphate of potash and magnesia, 300 lbs., per acre in 1889 and 1890, (muriate of potash, 200 lbs., substituted, each year since), dried blood, 300 lbs., mineral superphosphate, No. 1, 500 lbs. per acre used each year from 1889 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizers again used as at first	12 162	9 399	6 1940	7 80	11 1594	9 159
20	Wood ashes, unleached, 1,900 lbs. per acre used each year from 1889 to 1899, inclusive. No fertilizer used from 1900 tu 1905. From 1905-9 fertilizer again used as at first...........	10 1713	8 1082	6 1100	6 700	10 1235	8 839
21	Bone, finely ground, 500 lbs., sulphate of ammonia, 200 lbs., muriato of potash, 200 lbs. per acre, used each year from 1889 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizers again used as at first	12 38	7 1448	9 1200	6 200	11 1769	7 1268

PLOTS OF MANGELS AND TURNIPS.

In conducting these experiments, the roots only have been taken from the land, the tops have always been cut off and left on the ground to be ploughed under, so that the plant food they have taken from the soil has been returned to it. One-half of each one-tenth acre plot in the series has been devoted to the growth of mangels, and the other half to turnips, and these crops have been alternated from year to year. The preparation of the land has been the same for both these roots. Until 1900 it was

ploughed in the autumn after the crop was gathered, gang-ploughed deeply in the spring after the barnyard manure had been spread on plots 1, 2 and 6, and after gang-ploughing, the other fertilizers were spread by scattering them evenly over the surface, after which it was all harrowed with the smoothing harrow, then made in ridges 2 feet apart, rolled and sown.

The variety of mangel principally grown was the Mammoth Long Red, and about four pounds of seed were sown per acre each year.

The variety of turnip chiefly sown was the Prize Purple Top Swede. The land used for the turnips, which are usually sown later than the mangels, was prepared in the same manner. It was then allowed to stand until the day before sowing, when it was gang-ploughed shallow or cultivated to kill weeds and loosen the soil, ridged, rolled and sown. About three pounds of seed were sown per acre.

In 1900 and 1903, no crops of mangels or turnips were grown, but clover was sown in their place in May at the rate of 12 pounds per acre. This made a strong growth and was cut twice each year during the season, and left on the ground to decay, so that when ploughed under, the land might get the full benefit of the clover crop. The clover was allowed to remain growing until near the middle of May, the year following, by which time it had made a very heavy growth. It was then ploughed under about 6 inches deep aud harrowed well, then made into ridges 2 feet apart. These were rolled with a hand roller, which flattened the ridges considerably aud made a firm, even seed bed. The crops of clover and roots were alternated in this way, for the purpose of supplying humus and also of gaining information as to the fertilizing effect of green clover ploughed under on land to be used for growing roots.

From 1904 to 1909, inclusive, the roots were grown each year. In 1909 both the mangels and the turnips were sown on May 26, and pulled on October 12. The yield per acre has been calculated in each case from the weight of roots gathered from the whole plot.

EXPERIMENTS WITH FERTILIZERS ON PLOTS OF MANGELS AND TURNIPS.

No. of Plot.	Fertilizers applied each year from 1889 to 1898 or 1899. No fertilizer used from that time to 1905. Clover sown in 1900 in place of the roots and ploughed under in May, 1901, before the roots were sown. In 1903 clover was again sown and ploughed under in May, 1904. In 1905-9 fertilizers again applied as in 1899. Clover discontinued.	Average Yield for Seventeen Years. Mangels, Weight of Roots. Per acre.		Average Yield for Seventeen Years. Turnips, Weight of Roots. Per acre.		18th Season, 1909, Varieties. East Half Plot. Turnips, Purple Top Swede, Weight of Roots. Per acre.		18th Season, 1909, Varieties. West Half Plot. Mangels, Mammoth Long Red, Weight of Roots. Per acre.		Average Yield for Eighteen Years. Mangels, Weight of Roots. Per acre.		Average Yield for Eighteen Years. Turnips, Weight of Roots. Per acre.	
		Tons.	lbs.	Tons.	lbs.	Tons.	lbs.	Tons.	lbs.	Tons.	lbs.	Tons.	lbs.
1	Barn-yard manure (mixed horse and cow-manure) well rotted, 20 tons per acre each year from 1889 to 1898 inclusive. No manure used from 1899 to 1905. From 1905-9, manure was again used as at first.	21	377	14	605	14	680	17	1500	20	195	14	609
2	Barn-yard manure (mixed horse and cow-manure) fresh, 20 tons per acre each year from 1889 to 1898 inclusive. No manure used from 1889 to 1905. From 1905-9 manure was again used as at first.	20	990	14	846	15	440	20	20	20	936	14	935
3	Unmanured from the beginning .	8	663	6	1447	4	1200	3	1480	8	153	6	1211
4	Mineral phosphate, untreated, finely ground, 1,000 lbs. per acre, used each year from 1889 to 1897, inclusive. In 1898 and 1899 a similar weight of the Thomas' phosphate was used. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as in 1899	8	644	7	1011	8	260	4	140	8	172	7	1080

EXPERIMENTS WITH FERTILIZERS ON PLOTS OF MANGELS AND TURNIPS—*Con*.

No. of Plot.	Fertilizers applied each year from 1889 to 1898 or 1899. No fertilizers used from that time to 1905. Clover sown in 1900 in place of the roots and ploughed under in May, 1901, before the roots were sown. In 1903 clover was again sown and ploughed under in May, 1904. From 1905-9 fertilizers again applied as in 1899. Clover discontinued.	Average Yield for Seventeen Years. Mangels, Weight of Roots.	Average Yield for Seventeen Years. Turnips, Weight of Roots.	18th Season, 1909, Varieties. East Half Plot. Turnips, Purple Top Swede, Weight of Roots.	18th Season, 1909, Varieties. West Half Plot. Mangels, Mammoth Long Red, Weight of Roots.	Average Yield for Eighteen Years. Mangels, Weight of Roots.	Average Yield for Eighteen Years. Turnips, Weight of Roots.
		Per acre.	Per acre.	Per acre.	Per acre.	Per acre.	Per acre.
		Tons. lbs.	Tons. lbs.	Tons. lbs.	Tons. lbs.	Tons. lbs.	Tons. lbs.
5	Mineral phosphate, untreated, finely ground, 1,000 lbs., nitrate of soda, 250 lbs., wood ashes, unleached, 1,000 lbs. per acre, used each year from 1889 to 1897 inclusive. In 1898 and 1899, 500 lbs, of Thomas' phosphate were used in place of the mineral phosphate. No fertilizers used from 1900 to 1905. From 1905-9 fertilizers again used as in 1899.	14 1026	9 997	11 20	16 1260	14 1261	9 1108
6	Barn-yard manure, partly rotted and actively fermenting, 6 tons per acre, mineral phosphate, untreated, finely ground, 1,000 lbs. per acre, composted together, intimately mixed and allowed to heat for several days before using, applied each year from 1889 to 1897 inclusive. In 1898, 1,000 lbs. of Thomas' phosphate were used in place of the mineral phosphate. No fertilizers used from 1899 to 1905. From 1905-9 fertilizers again used as in 1898.	16 1889	11 1325	12 280	16 940	16 1836	11 1328
7	Mineral phosphate, untreated, finely ground, 1,000 lbs. sulphate of potash, 200 lbs. in 1889 and 1890 (substituted by muriate of potash, 250 lbs. in 1891 and subsequent years), nitrate of soda, 200 lbs. per acre, used each year from 1889 to 1897 inclusive. In 1898 and 1899 1,000 lbs. of the Thomas' phosphate were used in place of the mineral phosphate. No fertilizers used from 1900 to 1905. From 1905-9 fertilizers again used as in 1899	12 760	8 1755	10 1200	16 1920	12 1213	8 1947
8	Mineral superphosphate, No. 1, 500 lbs., sulphate of potash, 200 lbs. in 1889 and 1890 (substituted by muriate of potash, 250 lbs. in 1891 and subsequent years), nitrate of soda, 200 lbs. per acre, used each year from 1889 to 1899 inclusive. No fertilizers used from 1900 to 1905. From 1905-9 fertilizers again used as in 1899..........	13 1288	10 1857	12 940	14 460	13 1353	11 28
9	Mineral superphosphate, No. 1, 500 lbs. per acre, used each year from 1889 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as in '99.	9 766	8 1462	11 420	8 200	8 624	8 1738
10	Nitrate of soda, 300 lbs. per acre, used each year from 1889 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer used again as in 1899.........	13 811	8 1837	12 1240	9 1800	13 422	9 248
11	Sulphate of ammonia, 300 lbs. per acre, used each year from 1889 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer used again as in 1899 . . .	11 1073	10 63	10 640	5 1060	11 406	10 95

EXPERIMENTS WITH FERTILIZERS ON PLOTS OF MANGELS AND TURNIPS—*Concluded.*

No. of Plot.	Fertilizers applied each year from 1889 to 1898 or 1899. No fertilizers used from that time to 1905. Clover sown in 1900 in place of the roots and ploughed under in May, 1901, before the roots were sown. In 1903 clover was again sown and ploughed under in May, 1904. From 1905-9 fertilizers again applied as in 1899. Clover discontinued.	Average Yield for Seventeen Years. Mangels, Weight of Roots. Per acre.		Average Yield for Seventeen Years. Turnips, Weight of Roots. Per acre.		18th Season, 1909, Varieties. East Half Plot. Turnips, Purple Top Swede, Weight of Roots. Per acre.		18th Season, 1909, Varieties. West Half Plot. Mangels, Mammoth Long Red, Weight of Roots. Per acre.		Average Yield for Eighteen Years. Mangels, Weight of Roots. Per acre.		Average Yield for Eighteen Years. Turnips, Weight of Roots. Per acre.	
		Tons.	lbs.	Tons.	lbs.	Tons.	lbs.	Tons.	lbs.	Tons.	lbs.	Tons.	lbs.
12	Unmanured from the beginning....	6	1700	6	1357	3	0	2	200	6	1172	6	948
13	Bone, finely ground, 500 lbs., wood ashes, unleached, 1,000 lbs. per acre, used each year from 1889 to 1899 inclusive. No fertilizers used from 1900 to 1905. From 1905-9 fertilizers again used as at first. .	11	1558	8	659	9	160	7	1020	11	1084	8	743
14	Wood ashes, unleached, 2,000 lbs. per acre, used each year from 1889 to 1899, inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first..	10	1533	7	1441	5	1960	8	80	10	1230	7	1248
15	Common salt (Sodium chloride), 400 lbs. per acre, used each year from 1889 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first..	9	966	7	330	5	1120	5	160	9	477	7	152
16	Mineral superphosphate, No. 1, 500 lbs., nitrate of soda, 200 lbs. per acre, used each year from 1889 to 1899 inclusive. No fertilizers used from 1900 to 1905. From 1905-9 fertilizers again used as at first. ..	11	1745	9	936	12	1960	8	520	11	1344	9	1326
17	Mineral superphosphate, No. 1, 350 lbs., wood ashes, unleached, 1,500 lbs. per acre, used each year from 1889 to 1899 inclusive. No fertilizers used from 1900 to 1905. From 1905-9 fertilizers again used as at first	12	1015	10	199	8	1720	9	1220	12	693	10	61
18	Mineral superphosphate, No. 1, 500 lbs., muriate of potash, 200 lbs. per acre, used each year from 1889 to 1899 inclusive. No fertilizers used from 1900 to 1905. From 1905-9 fertilizers again used as at first..	12	1499	10	810	9	160	13	60	12	1530	10	663
19	Double sulphate of potash and magnesia, 300 lbs. per acre in 1889 and 1890 (muriate of potash, 200 lbs., substituted each year since), dried blood, 250 lbs., mineral superphosphate No. 1, 500 lbs. per acre, used each year from 1889 to 1899 inclusive. No fertilizers used from 1900 to 1905. From 1905-9 fertilizers again used as at first........	13	1616	11	138	11	220	14	140	13	1645	11	143
20	Wood ashes, unleached, 1,500 lbs., common salt (Sodium chloride), 300 lbs. per acre, used each year from 1889 to 1899 inclusive. No fertilizers used from 1900 to 1905. From 1905-9 fertilizers again used as at first.	14	1207	9	1655	8	160	11	920	14	858	9	1461
21	Mineral superphosphate, No. 2, 500 lbs. per acre, used each year from 1889 to 1899 inclusive. No fertilizer used from 1900 to 1905. From 1905-9 fertilizer again used as at first...	13	1533	10	220	8	520	8	1800	13	992	10	15

The final result of these experiments may perhaps be presented more clearly by dividing them into three groups covering three periods. namely:—1. Fertilizers used as originally planned, from 1888 to 1898 and 1899. 2. Fertilizers discontinued and clover grown. 1900-1904. 3. Fertilizers again used as in the first period.

In the following tables will be found the average returns per acre of the different crops grown, during each of these periods.

WHEAT.

No. of Plot.	Fertilizer applied during First and Third Periods.	Average First period 1888–1898 & 99. (Fertilizers.)		Average Second Period 1899–1904. (Clover Grown.)		Average Third Period 1905–1910. (Fertilizers.)	
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.
1	Manure (rotted)	20	56	25	43	18	0
2	Manure (fresh)......................	26	52	27	11	14	0
3	Unmanured...	10	18	15	7	7	58
4	Mineral Phosphate...................	10	23	17	14	10	6
5	Phosphate, Nitrate of Soda.........	12	31	15	15	11	56
6	Manure, Phosphate	18	11	21	50	16	26
7	Phosphate, Nitrate of Soda, Wood ashes.	12	44	16	37	12	36
8	Phosphate, Wood ashes	10	42	14	41	10	0
9	Superphosphate...	11	37	14	49	9	56
10	Superphosphate, Nitrate of Soda....	12	58	14	6	10	50
11	Superphosphate, Nitrate of Soda, Wood ashes.................. ...	13	56	15	31	12	12
12	Unmanured....................	9	40	13	7	7	2
13	Bone............................ .	11	43	15	23	9	58
14	Bone, Wood ashes	15	9	16	28	13	28
15	Nitrate of Soda............... .	13	18	16	53	11	18
16	Muriate of Potash..................	15	19	16	28	11	26
17	Sulphate of Ammonia....	12	5	15	25	10	8
18	Sulphate of Iron...	12	26	13	58	9	27
19	Salt....	13	20	15	17	9	36
20	Gypsum..	12	30	13	50	9	58
21	Phosphate.....................	12	33	14	50	10	28

BARLEY.

1	Manure (rotted).	34	35	37	45	36	2
2	Manure (fresh)..........	35	21	36	3	39	14
3	Unmanured	13	30	17	26	14	14
4	Mineral Phosphate.	13	27	20	29	16	46
5	Phosphate, Nitrate of Soda.........	19	45	24	31	26	4
6	Manure, Phosphate.....	28	5	30	36	33	4
7	Phosphate, Nitrate of Soda, Wood ashes.........................	23	34	33	33	32	28
8	Phosphate, Wood ashes.	19	26	29	21	25	28
9	Superphosphate	20	35	24	39	20	35
10	Superphosphate, Nitrate of Soda....	27	2	27	44	28	6
11	Superphosphate, Nitrate of Soda, Wood ashes	26	8	29	46	30	20
12	Unmanured........................	13	1	17	30	13	12
13	Bone.............................	13	33	20	5	17	38
14	Bone, Wood ashes......	22	19	28	17	26	16
15	Nitrate of Soda...	21	37	22	20	20	16
16	Muriate of Potash.	22	3	24	36	22	18
17	Sulphate of Ammonia.....	18	11	22	3	17	42
18	Sulphate of Iron..................	17	34	21	39	19	18
19	Salt.............................	27	44	25	22	26	26
20	Gypsum	19	22	23	11	19	4
21	Mineral Phosphate................	20	7	24	7	19	29

OATS.

No. of Plot.	Fertilizer applied during First and Third Periods.	Average First period 1888-1889 & 99. (Fertilizers.)		Average Second period 1899-1904. (Clover Grown.)		Average Third period 1905-1910. (Fertilizers.)	
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.
1	Manure (rotted).............	48	14	57	8	51	8
2	Manure (fresh)............	54	17	57	26	49	26
3	Unmanured.............	30	20	44	6	26	12
4	Mineral Phosphate.......	30	23	47	3	35	24
5	Phosphate, Nitrate of Soda.........	48	21	51	2	41	2
6	Manure, Phosphate......	44	59	56	26	43	16
7	Phosphate, Nitrate of Soda, Wood ashes.........	46	9	56	10	40	27
8	Phosphate, Wood ashes.	40	8	54	5	34	33
9	Superphosphate	35	0	47	17	30	5
10	Superphosphate, Nitrate of Soda ...	46	21	49	7	38	14
11	Superphosphate, Nitrate of Soda, Wood ashes	36	4	45	3	28	6
12	Unmanured....	21	9	29	23	15	32
13	Bone..............	33	25	39	20	27	26
14	Bone, Wood ashes.......	37	28	51	19	33	26
15	Nitrate of Soda	46	7	48	21	36	18
16	Muriate of Potash...........	34	24	52	3	36	30
17	Sulphate of Ammonia	43	21	51	0	42	28
18	Sulphate of Iron......	35	13	48	26	37	18
19	Salt	35	5	48	31	38	8
20	Gypsum.....	32	24	42	6	35	8
21	Mineral Phosphate......	33	6	43	29	35	28

INDIAN CORN

No. of Plot.	Fertilizer applied during First and Third Periods.	Average First Period 1888-1898 & 99. (Fertilizers.)				Average Second Period 1899-1904. (Clover Grown.)				Average Third Period 1904-1910. (Fertilizers.)			
		1st. Plot.		2nd. Plot.		1st. Plot.		2nd. Plot.		1st. Plot.		2nd. Plot.	
		Tons.	lbs.	Tons.	lbs.	Tons.	lbs.	Tons.	lbs.	Tons.	lbs.	Tons.	lbs.
1	Manure (rotted)........-..........	16	240	12	696	17	357	15	830	14	1266	11	1550
2	Manure (fresh).....................	17	724	11	785	13	742	12	195	12	1692	10	1862
3	Unmanured.......................	7	323	5	410	7	706	6	493	2	1464	2	1747
4	Phosphate	6	1840	4	305	13	1647	10	1147	5	1830	5	728
5	Phosphate, Nitrate of Soda.	10	932	8	1408	16	827	11	1260	8	1212	8	40
6	Manure, Phosphate....	16	729	11	899	15	1770	14	108	11	1498	9	1974
7	Phosphate. Nitrate of Soda, Wood ashes........	14	1347	10	1380	17	857	13	1780	10	1758	9	944
8	Phosphate, Wood ashes............	11	279	8	456	16	1703	15	633	9	440	7	1658
9	Superphosphate..	10	264	7	1309	16	733	13	1020	8	174	6	306
10	Superphosphate, Nitrate of Soda.	12	1854	10	39	15	1883	13	13	7	1890	6	1308
11	Superphosphate, Nitrate of Soda, Wood ashes	15	944	11	1146	19	887	16	450	11	598	9	1066
12	Unmanured	10	202	8	500	14	1777	12	1717	6	1456	5	748
13	Bone	11	327	8	1145	16	1387	13	1447	7	1106	6	502
14	Bone, Wood ashes................	11	1164	8	1497	17	1750	15	1067	9	1770	8	972
15	Nitrate of Soda.........	12	384	9	607	13	1960	11	977	7	1134	6	728
16	Sulphate of Ammonia.....	12	1009	9	1239	15	1060	12	980	7	1824	6	1888
17	Superphosphate, Muriate of Potash.	12	1297	8	1773	17	553	15	440	10	1102	8	974
18	Muriate of Potash................	8	1138	5	1534	16	727	14	667	8	1072	7	628
19	Muriate of Potash, Blood, Superphosphate....	11	458	7	1225	16	1993	15	583	10	726	9	8
20	Wood ashes..................... ..	9	1016	6	1841	17	1223	15	233	9	792	8	368
21	Bone, Sulphate, Ammonia, Muriate of Potash.......................	12	222	6	692	15	47	14	223	9	1642	7	146

MANGELS AND TURNIPS.

	Fertilizers applied during First and Third Period.	Average First Period 1888-1898 & 99. (Fertilizers.)				Average Second Period 1899-1904. (Clover grown.)				Average Third Period 1904-1910. (Fertilizers.)			
		Mangels.		Turnips.		Mangels.		Turnips.		Mangels.		Turnips.	
		Tons.	lbs.	Tons.	lbs.	Tons.	lbs.	Tons.	lbs.	Tons.	lbs.	Tons.	lbs.
1	Manure (rotted)................ ...	23	212	15	196	19	47	19	175	18	1202	9	344
2	Manure (fresh......	22	269	15	854	17	700	18	862	19	1550	9	716
3	Unmauured	8	1587	6	1863	9	1787	11	293	5	1376	3	686
4	Phosphate...........	8	644	7	593	10	1753	13	1257	6	134	4	1160
5	Phosphate, Wood ashes, Nitrate of Soda..........	13	1732	9	1436	16	1480	13	1200	15	212	6	1804
6	Manure, Phosphate............. ..	18	859	13	514	15	1030	13	1357	15	108	7	1224
7	Phosphate, Nitrate of Soda, Muriate of Potash............	10	1472	9	1012	14	1343	11	197	15	742	6	1300
8	Sulphate of Potash, Nitrate of Soda.	13	1725	11	1730	13	1563	12	940	13	586	8	766
9	Superphosphate..........	9	120	8	1327	12	497	14	410	8	572	6	494
10	Nitrate of Soda	14	520	9	134	13	1467	12	1150	10	1646	7	488
11	Sulphate ammonia.................	10	145	10	667	12	603	13	1630	8	928	7	572
12	Unmanured................	7	354	6	677	8	1213	10	1753	4	498	3	410
13	Bone....... :..	10	196	8	616	11	1613	13	10	9	1820	5	1712
14	Wood ashes......	10	1508	7	1107	12	1047	13	380	9	608	4	1244
15	Salt..........	9	961	7	21	11	943	11	1677	7	1090	3	1110
16	Superphosphate, Nitrate of Soda...	13	589	10	711	11	580	14	1717	8	990	7	756
17	Superphosphate, Wood ashes.......	12	985	9	31	16	1157	18	1963	9	1466	7	38
18	Superphosphate, Muriate of Potash.	12	415	9	1900	15	680	18	537	12	1004	6	1204
19	Muriate of Potash, Blood, Superphosphate.......	13	1150	11	737	16	1257	17	1140	12	1802	6	1468
20	Ashes, Salt....................	14	202	10	183	18	223	16	773	13	146	5	154
21	Superphosphate...	14	1190	10	903	15	990	16	1230	9	1936	5	602

REPORT OF EXPERIMENTS IN AGRICULTURE AND HORTICULTURE AT KAMLOOPS, B.C.

The following report under date of March 31, 1910, has been received from Mr. E. W. Calhoun, Superintendent of the Harper Ranch, Kamloops, B.C., on some experiments which are being conducted under the instructions of the Minister of Agriculture by the Director of Experimental Farms, on ten acres of land set aside for that purpose on the Harper Ranch.

Arrangements have been made for conducting, on this area, tests of winter wheat, spring wheat, rye, barley, oats, potatoes, &c. Furthermore, a portion has been set aside for experiments with apple trees. These tests have been arranged to ascertain the best methods of procedure in growing grain, &c., under dry-farming conditions, especially with a view of learning the advantages, if any, attending the use of certain implements known as soil packers:—

HARPER RANCH, KAMLOOPS, B.C.,
March 31, 1910.

To Dr. Wm. SAUNDERS, C.M.G.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I beg to submit the following report of the work done on the ten acres of land retained for experimental purposes by the Dominion government on the Harper Ranch, Kamloops, B.C.

The ten acre plot of land referred to has been fenced with posts 20 feet apart and five wires. It was broken about four inches deep during the latter part of May last,

and, during the first two weeks in June, was disc harrowed twice each way and drag harrowed. It was backset about six inches deep the third week in June and drag harrowed several times at different intervals, so as to retain the moisture before seeding.

On the 31st of August, the following seeding was done:—

½ acre Winter Wheat, Turkey Red, at 1 bushel to the acre.
½ " " " 1 " "
½ " " " ½ " "

The Campbell packer was used on the two latter plots before seeding.

½ acre Winter Rye at 60 lbs. to the acre.

Packer used on this plot also.

This grain all came up nicely and looked promising before the winter set in, but, owing to there having been practically no snowfall during the winter, a condition which has been, I am sorry to say, universal throughout this section of the interior of British Columbia, you can understand that the grain has consequently been exposed to frost. While it may yet come out all right, the prospects are not very encouraging, whereas, if we had got the usual snowfall, the grain would not only have been protected from the frost, but, as the ground was so well cultivated, it would have retained a large percentage of the moisture from the melted snow which would have materially assisted growth in the early spring, so that the grain would have shaded the ground before the hot weather set in.

We shall sow the spring grain already received and the trees to be forwarded, as you may direct.

I have the honour to be, sir,

Your obedient servant,

E. W. CALHOUN.

REPORT ON AGRICULTURAL AND HORTICULTURAL EXPERIMENTS ON THE WHITEFISH RIVER NEAR LAKE ABITIBI.

During the spring of 1909, arrangements were made with Mr. Frank Moberley to conduct some agricultural and horticultural experiments on his farm near Lake Abitibi, on the Whitefish River.

Five acres were placed at the disposal of the Experimental Farms for experimental purposes covering tests of the more important varieties of grain and other agricultural and horticultural products.

Mr. Moberley has submitted the following report, giving the results obtained from trial plots of various samples forwarded to him for test:—

BARRIE, ONTARIO, October 4, 1909.

To Dr. WM. SAUNDERS, C.M.G.,
Director. Dominion Experimental Farms,
Ottawa, Ont.

SIR,—I beg to make the following report of experiments in growing different grains, &c., at Whitefish River, 10 miles north of Lake Abitibi in the province of Quebec.

The different samples of grains and the trees and shrubs forwarded from the Experimental Farm all reached me at Matheson in good condition, except two or three of the ornamental shrubs and the gooseberries, which did not grow.

The opening of Lake Abitibi was very late and I did not arrive at Whitefish until the 29th of May and immediately set to work to get the ground in order and seeds in as soon as possible. There had been very little rain in May and the old ground was dried and so hard it was difficult to work. On June 1, I sowed White Fife wheat,

Thousand Dollar. Wide Awake and Ligowo oats, peas and flax, and on June 2, Stanley wheat, barley and rye (the latter did not come up). Also during these two days planted potatoes; sowed lettuce, radishes, carrots, beets, onions, salsify, peas and corn; from this time on until the 12th of July there was little rain, only in sprinkling showers which had no effect on the hard clay, so until the latter date the seed lay dormant. Besides being so dry the prevailing winds were from the north and west, which are cold quarters. From time to time as a little rain fell we sowed timothy and red clover, and although I was not able to carry out the seeding of these latter as extensively as intended owing to weather conditions, yet they proved the only satisfactory part of the whole operations. When growth really did commence the weather was so cold as to retard it very much, and as you will see by daily weather report, which I send herewith, the readings of the thermometer are very low and indicate frost on several occasions in July. August was more favourable in regard to weather until the 21st, when there was a frost which about put an end to most of the crop both in field and garden. After this date the weather was wet and cold so that no recovery was possible until I cut the grain on September 15. It had not filled out at all but was very light, but straw was of a good length.

The flax did fairly well, and if we had had an average season it would have been a good crop, and I have no doubt the other grains would have succeeded as well.

The timothy and red clover have both taken well, and I attach a photograph of a corner of the clover patch. I have left it to see how it will pull through the winter.

Some of the vegetables were still growing, such as carrots and salsify, but the peas, both field and garden, were a perfect failure; during the two previous seasons they were an abundant crop; lettuce and radishes were good, but everything else a failure, even artichokes.

The little apple trees that were sent up this season did very well, as did the ornamental shrubs. The apple trees that have been at Whitefish two years made a good growth, although they had been damaged a good deal by mice last winter, which also attacked the Quebec native plum trees and currant bushes, but both recovered. The potatoes would have been a good crop if they had had a chance to ripen. I planted Peck's Early and the American Wonder.

I am more than disappointed at results of the season's work, as I had fully counted on its being a success.

You will notice on daily weather record the prevalence of north winds.

I may say that, while the above were the conditions of Whitefish farm, 10 miles north of Lake Abitibi, at the Hudson Bay Company post on the lake shore, where a large field of potatoes was planted only a small shaded corner of the crop was touched by the August frost, and the balance was not touched when I left on September 21.

* I forwarded some specimens of the crop such as it was.

Enclosed are weather reports for June, July, August and part of September, and also some photographs taken at Whitefish farm, and I would call your attention particularly to the one of a corner of the clover patch.

I have the honour to be, sir,

Your obedient servant,

(Signed) FRANK MOBERLEY.

* The samples of grain received from Mr. Moberley were quite immature; the potatoes also were only about half-grown, whereas potatoes received later from the Hudson Bay Company's post referred to were of fairly good quality.

TABLE of meteorological observations taken at Whitefish. Pontiac county, near Lake Abitibi. Quebec, from June 1 to September 18. 1909, showing maximum, minimum and mean temperature; also highest and lowest for each month, with date of occurrence; also rainfall and number of days with precipitation.

Month.	Maximum.	Minimum.	Range.	Mean.	Highest.	Date.	Lowest.	Date.	Rainfall.	Number of days Precipitation.	Heaviest in 24 hours.	Date.
	°	°	°	°	°		°					
June	69·60	38·36	31·23	53·97	85·0	4th	25 0	19th	1·42	8	0·58	17th
July	72·19	45·67	26·51	58·92	86·0	9th	29·0	5th	3·38	14	1·00	30th
August	72·90	46·61	26·29	59·75	86·0	7th	27·0	21st	4·00	13	0·76	31st
September	60 27	37·11	23·16	48·69	82 0	14th	24·0	9th	2·88	13	0 95	15th
									11·68	48		

The report for September is not complete, as there are no returns after the 18th of the month.

REPORT OF MR. ROBERT JONES ON EXPERIMENTS IN AGRICULTURE AND HORTICULTURE AT FORT VERMILION, ALBERTA.

FORT VERMILION, ALBERTA, March 31, 1910.

To Dr. WM. SAUNDERS, C.M.G.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I beg to submit the second annual report of work done on the experimental station at Fort Vermilion on the Peace River, with remarks on the condition of farm work in general throughout this district in 1909.

The spring of 1909 was late and very slow in opening, and seeding was not general until May 15 and was not finished until May 28. Cold weather prevailed all through May and germination of the seeds sown was very slow. On the night of June 3 a frost occurred which cut down squash, melons, tomatoes and cucumbers, but after this, fine weather was general and continued throughout July, growth was very rapid and there was every prospect of an abundant harvest.

On the night of August 18 a frost occurred which damaged the wheat crops considerably, reducing the yield by about one-third. Other frosts occurred on August 22, 26, 27 and 28, but oats and barley were far enough advanced to escape injury, and are quite up to the usual standard.

Harvest was general on August 23, but stacking was hindered by continued wet weather in September.

Apart from the experimental plots on the station, wheat will not, probably, anywhere average more than 17 bushels to the acre.

As little threshing has yet been done it is difficult to estimate the total yield or the amount of damage done by frost.

Gardens in the district were above the usual standard. A great deal of interest has been aroused and much impetus given to private planting by the work done on the experimental station, which is very encouraging.

The fruit trees and ornamental shrubs have done well. Growth has not been quite so rapid as last year, but I think that the wood is well ripened and that they will be better prepared to endure the winter.

Roses were in bloom from the end of June until the frost came and were very pretty. All the flowers bloomed freely and were much admired by all who saw them.

Wild hay was very scarce on the prairies and high lands, but was abundant and of a good quality in the swamps and around the lakes.

EXPERIMENTS WITH SPRING WHEAT.

Date of sowing, in all varieties, May 15.

Name of Variety.	Date of Ripening.	No. of Days Maturing.	Length of straw, including Head.	Character of Straw.	Length of Head.	Kind of Head.	Weight of Straw, Per acre.	Yield per Acre.		Weight per Measured Bushel after cleaning.
			In.		In.		Lbs.	Bush.	Lbs.	Lbs.
Red Fife	Sept. 5	113	39–42	Stiff	3½	Bald	3,584	21	14	63½
Bishop	Aug. 31	108	39–42	"	4	"	3,920	28	0	63½
Early Riga	" 27	104	39–42	"	3	"	2,632	19	8	64
Preston	Sept. 1	109	-8	Medium	5	Bearded	3,584	26	8	63½
Ladoga	" 1	109	48	"	4	"	3,500	25	40	64½

EXPERIMENTS WITH BARLEY.

All sown May 22.

Name of Variety.	Date of Ripening.	No. of Days Maturing.	Length of Straw, including Head.	Character of Straw.	Length of Head.	Weight of Straw.	Yield per Acre.	
			In.		In.	Lbs.	Bush.	Lbs.
Sidney (Two-rowed)	Aug. 27	97	38	Medium	3½	3,440	51	24
Canadian Thorpe (Two-rowed)	" 25	95	38	"	4	4,345	52	24
Claude (Six-rowed)	" 17	87	38	"	4	3.120	61	36
Mensury "	" 18	88	38	"	4	2,850	44	1

EXPERIMENTS WITH OATS.

Date of sowing, May 19, 1909.

Name of Variety.	Date of Ripening.	No. of Days Maturing.	Length of Straw, including Head.	Character of Straw.	Length of Head.	Kind of Head.	Weight of Straw, per acre.	Yield per Acre.		Weight per Measured Bushel.
			In.		In.		Lbs.	Bush.	Lbs.	Lbs.
Tartar King	Aug. 27	100	34	Strong	10	Sided	6,069	55	17	36¼
Banner	" 27	100	34	Medium	9	Branching	4,998	72	17	35
Improved Ligowo	" 27	100	34	"	9	"	5,654	60	0	....

EXPERIMENTS WITH FIELD PEAS.

Name of Variety.	Date of Sowing.	Date when Cut.	Character of Straw.	Length of Straw.	Length of Pod.	Size of Pea.	Yield per Acre.	
				In.	In.		Bush.	Lbs.
Arthur	May 17	Sept. 2	Strong	42	2½	Medium	22	24
*Golden Vine	" 19	" 18						

* Very green when cut; will not be fit for seed.

INDIAN CORN.

Sown May 17 in one-twentieth acre plots.

Name of Variety.	Height.	Leafiness.	When Tasselled.	In Silk.	Condition when Cut.	Weight per acre grown in hills.	
	In.					Tons.	Lbs.
Longfellow	66	Very leafy	Aug. 22	Aug. 25	Green	8	1,745
Compton's Early	58	Leafy	" 26	" 26	"	6	1,728
Dakota White	50	"	" 24		"	5	1,440

SWEET CORN.

Pochahontas	38	Leafy	Aug. 10	Aug. 15	Fit for use Aug. 24.	
Hiawatha	38	"	" 12		Green	

Weights estimated after cured.

EXPERIMENTS WITH FIELD ROOTS.

Name of Variety.	Weight. Per acre.	
	Tons.	Lbs.
Turnips—		
Good Luck	17	464
Perfection Swede	15	1,416
Mangels—		
Prize Mammoth Long Red	14	480
Giant Yellow Intermediate	16	1,800
Sugar Beets—		
Vilmorin's Improved	12	1,600
Klein Wanzleben	11	984
Carrots—		
Improved Short White	18	950
Half-Long Chantenay	14	215

EXPERIMENTS WITH POTATOES.

Name of Variety.	Date of Planting.	Date of Digging.	Yield per acre.	Average size.	Form and Colour.
1 Everett	May 18	Sept. 15	412 bush.	Medium	Long, Pink.
2 Carman No. 1	"	"	401 bush. 42 lbs.	Large	Oval, White.
3 Early White Prize	"	"	384 bush. 32 lbs.	Medium	" "
4 Rochester Rose	"	"	370 bush. 48 lbs.	Large	Long, Red.
5 Burpee's Extra Early	"	"	343 bush. 20 lbs.	Large	Round, Pink.

ALFALFA.

Up to the present date, October 6, 1909, this is doing remarkably well. At the second cutting on August 10, I obtained about one ton from the various small plots. It remains now to be seen what will happen to it during our severe winter.

VEGETABLE GARDEN.

GARDEN PEAS.

'Gradus.'—These were sown on May 17, and were fit for use on July 19. The pods were long and well filled. The straw was 30 inches high and well loaded.

'Stratagem.'—This pea was also sown on May 17, but the seed had been attacked by insects, and very few of them germinated. Those that did germinate produced well and were fit for the table on July 20.

GARDEN BEANS.

'Improved Golden Wax.'—Sown on May 19 and were fit for table on August 1. The pods were about 5 inches long, and quickly ripened after becoming fit for table.

'Early Refugee.'—These were sown May 19 and were fairly vigorous in growth and very productive. The pods measured from 3 to 4 inches. They remained fit for table a long time.

BEETS.

'Market King.'—These were sown on May 20 and were ready for table July 26. Crisp and sweet and very good.

'Dwarf, Red, Bonsecour's Market.'—Also sown May 20. Fit for use July 26. Very good.

PARSNIPS.

'Hollow Crown.'—Sown May 20 and fit for use in August. A very strong grower and produced roots of large size.

SQUASH.

'Boston.'—Transplanted from hotbed on May 25, and did fairly well. From two plants I obtained five squash, which were cut in September, the largest of which weighed 6 lbs.

'Summer Golden Crockneck,' 'Hubbard.'—These were transplanted on the same date, but were killed by frost during summer, as were also muskmelon and cucumber.

PARSLEY.

'Extra Curled.'—This was sown on May 24 and was in use July 1. A good crop.

TABLE CARROTS.

'Early Horn.'—Sown on May 20 and fit for table on July 18. Crisp and sweet, and grew very large.

TABLE TURNIPS.

'Early White Stone.'—Sown on May 24 and were fit for use July 1. A very rapid grower and of fine flavour.

ONIONS.

'Danver's Yellow.'—Sown May 20. This variety grew well and were very large.

'Large Red Wethersfield.'—Sown same date. These were very large, solid and close grained. From the two small packages of seed sent I obtained 170 lbs.

LETTUCE.

'Paris Market.'—Sown May 20 and in use June 20. Very fine. At the end of August several head weighed as much as 1 lb. 2 ozs. each.

RADISH.

'French Breakfast.'—Sown May 20; ready for table June 19. Very fine indeed.

ASPARAGUS.

This was sown May 20 and did very well. I have about 105 good, strong plants, which have been transplanted into permanent beds and are doing well.

TOMATOES.

'Atlantic City.'—These were sown on May 6 in hotbed and transplanted into the open on May 22 and I obtained from 50 plants about 2 bushels of partly ripe fruit.

CABBAGES.

Two varieties were sown in hotbed on May 5 and were transplanted into the open on June 3. Both varieties did well, 'Early Jersey Wakefield' being ready July 30, and when pulled on September 10, many of them weighed 16 lbs. each. The other variety, 'Premium Large Flat Dutch,' were also up to the same state of perfection.

CAULIFLOWERS.

On the same date, May 5, one variety of cauliflower was sown in hotbed and transplanted on June 2. The variety was 'Early Snowball.' They did well and were fit for table on August 1. When pulled on September 10 some weighed as much as 11 lbs. each.

THE FLOWER GARDEN.

Name of Variety.	Set Out.	In Bloom From	In Bloom To	Remarks.
Verbena hybrida Mammoth	All sown in open ground from 22nd to 27th of May.			Did not germinate.
Antirrhinum, Tom Thumb		July 25th	Sept. 18th	Very fine.
Portulaca grandiflora		July 24th	Sept. 18th	do
Dianthus Chinensis diadematus		Aug. 5th	Sept. 18th	do
Poppy, "The Shirley"		July 18th	„ „	do
Poppy "Snowdrift"				Destroyed by cutworms.
Poppy "Iceland"				do
Poppy "Californian"		July 14th	Sept. 18th	Very fine indeed.
Dianthus laciniatus		Aug. 1st	Sept. 18th	do
Godetia		July 24th	Sept. 18th	Good.
Balsam Camelia-flowered				Cut down by frost.
Gaillardia picta Lorenziana		July 30th	Sept. 18th	Very fine.
Nasturtium Tall Royal Exhib. Strain		July 2nd	Sept. 18th	do
Nasturtium Tom Thumb		July 2nd	Sept. 18th	do
Antirrhinum, Choice Striped		Aug. 20th	Sept. 18th	do
Phlox Drummondii Grandiflora		July 20th	Oct. 6	
Pansy, Large flowering select		July 11st	Sept. 18th	do
Clarkia, mixed		July 1st	Sept. 18th	do
Stocks, German Tenweek		Aug. 4th	Sept. 18th	do
Coreopsis Drummondii		July 15th	Sept. 18th	Bloomed freely.
Candytuft, Empress	All sown in open ground.	July 9th	Oct. 6	Extra fine.
Mignonette		July 15th	Oct. 6	Very good.
Scabiosa, dwarf double		Aug. 1st	Sept. 18th	Bloomed freely.
Aster, Queen of the Market		Aug. 18th	Sept. 18th	Large flowers.
„ Victoria		Aug. 30th	Sept. 18th	Very nice.
„ Giant Comet		„ 30th	Sept. 18th	Good.
Sweet Peas, 8 varieties		July 14th	Sept. 18th	Large flowers in profusion.

RECORD of Sunshine at Fort Vermilion, Peace River District, Alberta, from April 1, 1909, to March 31, 1910.

Month.	Number of days with Sunshine.	Number of days without Sunshine.	Total hours Sunshine.	Average Sunshine per day.
April	30	0	245.6	8·18
May	31	0	257.1	8·29
June	28	2	333.3	11·11
July	29	2	313.7	10·11
August	30	1	276.6	8·92
September	25	5	188.7	6·29
October	24	7	109.2	3·52
November	21	9	80.6	2·68
December	25	6	96.1	3·10
January	15	16	51.0	1·64
February	26	2	157.2	5·61
March	26	5	144.2	4·65

I have the honour to be, sir,

Your obedient servant,

ROBT. JONES.

TABLE of Meteorological Observations taken at Fort Vermilion, Peace River District, Alberta, from April 1, 1909, to March 31, 1910, showing maximum, minimum, and mean temperature, also highest and lowest for each month with date of occurrence; also rainfall, snowfall, and total precipitation.

Month.	Maximum.	Minimum.	Range.	Mean.	Highest.	Date.	Lowest.	Date.	Rainfall	Snowfall.	Total Precipitation.	Number of days Precipitation.	Heaviest in 24 hours.	Date.
	°	°	°	°	°		°							
April	31·72	6·06	25·66	18·89	48·7	9th	—28·2	12th	0·38	1·00	0·72	4	0·38	9th.
May	58·49	34·93	23·55	46·70	83·4	27th	14·7	1st	2·11	....	2·11	10	0·71	21st.
June	72·59	42.64	29·95	57·61	97·7	14th	30·2	1st	1·27	....	1·27	5	0·92	17th.
July	73·66	48·40	25·26	61·03	81·5	6th	34·4	1st	2·96	....	2·96	9	0·98	5th.
August	68·30	42·83	25·47	55·56	84·0	13th	30·2	18th	1·80	....	1·80	9	0·60	20th.
September	60·29	37·28	23·00	48·78	75·0	25th	22·0	22nd	1·30	....	1·30	7	0·50	8th.
October	41·46	27·15	14·30	34·30	64·0	4th	11·8	11th	0·31	0·25	0·33	5	0·17	17th.
November	11·73	— 9·13	20·86	1·30	45·0	3rd & 5th.	—35·0	20th	....	1·75	0·17	4	0·05	9th.
December	7·83	—17·06	24·90	—4·61	37·0	16th	—46·0	2nd	....	0·50	0·05	1	0·05	12th.
January	10·37	—15·42	25·80	—2·52	34·2	31st	—32·0	17th	....	2·50	0·24	4	0·07	14th & 30th.
February	9·05	—24·93	33·98	—7·94	38·2	7th	—43·2	23rd	....	1·25	0·12	2	0·10	26th.
March	31·88	2·70	29·18	17·29	61·5	15th	—39·9	6th	....	5·00	0·50	5	0·20	28th.
	....	....	....	....	....	....	....	....	10·13	12·25	11·57	65	....	....

Some Weather Observations taken at Central Experimental Farm, Ottawa, as compared with those taken at Fort Vermilion, Peace River District, Alberta.

—	Mean Temp.	Highest Temp.	Lowest Temp.	Total Precipitation.	Heaviest in 24 hours.	Total Hours Sunshine.	Average Sunshine per day.
	April.						
	°	°	°				
Ottawa	37·46	64·0	14·5	3·71	0·83	172·7	5·75
Fort Vermilion	18·89	48·7	28·2	0·72	0·38	245·6	8·18
	May.						
Ottawa	53·59	75·5	30·5	5·84	1·34	195·5	6·30
Fort Vermilion	46·70	83·4	14·7	2·11	0·71	257·1	8·29
	June.						
Ottawa	65·68	91·8	39·9	2·52	0·83	255·0	8·50
Fort Vermilion	57·61	97·7	30·2	1·27	0·92	333·3	11·11
	July.						
Ottawa	67·16	89·8	47·0	4·69	1·09	236·9	7·64
Fort Vermilion	61·03	81·5	34·4	2·96	0·98	313·7	10·11
	August.						
Ottawa	67·97	95·6	42·0	3·11	1·25	279·7	9·02
Fort Vermilion	55·56	84·0	30·2	1·80	0·60	276·6	8·92
	September.						
Ottawa	57·84	84·8	36·6	2·81	0·59	190·6	6·35
Fort Vermilion	48·78	75·0	22·0	1·30	0·50	188·7	6·29
	October.						
Ottawa	45·24	76·8	21·8	1·11	0·35	134·8	4·34
Fort Vermilion	34·30	64·0	11·8	0·33	0·17	109·2	3·52
	November.						
Ottawa	35·64	63·6	6·0	3·18	1·10	87·9	2·93
Fort Vermilion	1·30	45·0	−35·0	0·17	0·05	80·6	2·68
	December.						
Ottawa	18·89	36·0	− 8·8	1·50	0·65	59·4	1·91
Fort Vermilion	− 4·61	37·0	−46·0	0·05	0·05	96·1	3·10
	January.						
Ottawa	17·90	41·0	−18·5	2·30	0·70	88·8	2·86
Fort Vermilion	− 2·52	34·2	−32·0	0·24	0·07	51·0	1·64
	February.						
Ottawa	12·88	43·4	−19·4	2·30	0·70	124·1	4·43
Fort Vermilion	− 7·94	38·2	−43·2	0·12	0·10	157·2	5·61
	March.						
Ottawa	33·59	72·6	− 3·3	1·44	0·44	214·8	6·92
Fort Vermilion	17·29	61·5	−39·9	0·50	0·20	144·2	4·65

WILLIAM T. ELLIS.

RESULTS OF EXPERIMENTS IN TREE PLANTING ON SABLE ISLAND.

In May, 1901, at the request of the Department of Marine and Fisheries, I conducted some experiments in tree planting on Sable Island. This is a lonely island which lies in the Atlantic Ocean about 153 miles northeast of Halifax. Owing to strong ocean currents and almost perpetual winds, this island is being gradualy reduced in size. Early surveys showed that it was almost 40 miles long, whereas its present length is about 21 miles. The gradual wasting of the island has led to the consideration of the possibility of establishing tree growth there so that the land might become more fixed and further lessening of the surface retarded if not prevented.

Selections of a number of varieties of the hardiest trees obtainable were made and shipped to Halifax. This shipment comprised, in all, 81,345 trees and shrubs, 68,755 of evergreens of 25 varieties, with 12,590 of deciduous sorts of 79 varieties.

With this shipment, we left Halifax in the government steamer *Minto*, on the afternoon of the 15th of May, 1901, and arrived at Sable Island on the morning of the 16th. A full account of the objects of this expedition, with details of the work undertaken, was published in the annual report of the Experimental Farms for 1901, p. 62, to which the reader is referred for full particulars.

After about ten days spent in planting and planning the work, its completion was left with the Superintendent of the Island, Mr. R. J. Boutellier, who carefully carried out the instructions given and completed the work on June 17. Letters were received from him in July, August and November of that year.

At first, the results of the work seemed fairly encouraging, but a severe drought, which lasted from August 13 to October 3, 1901, killed a large number of the trees, and the high winds which blew almost a continuous gale carried with them sharp particles of sand which bruised and destroyed the leaves of most of the deciduous things so that, after making two or three efforts to put out new foliage, and each time having it ground off by the cutting, drifting sand, most of them perished.

On May 26, 1902, a careful memorandum was prepared by Mr. Boutellier, giving the condition of the surviving trees, shrubs, &c., also of some further experiments in tree growing from seed; a list of the species which had survived was also given which, under date of July 21, 1902, showed a large proportion of loss. No reference has since been made to the results of this experiment, in the annual reports of the Experimental Farms.

During the month of October, 1909, I had a very pleasant visit in Ottawa from Mr. Boutellier, the Superintendent of Sable Island, when we discussed the condition of the remnants of the trees which had survived the constant grind of wind and sandstorm for eight years. He promised, on his return, to make a very careful examination and to send me an account of the condition of all the surviving trees. He returned to the island on November 17 and wrote me on March 23, 1910, as follows:—

'On January 25 and 26 I visited No. 4 Station at the east end of the Island and examined the plot carefully in which about 2,000 trees and shrubs were planted. I found the following alive as nearly as I could identify them. They were all spread out on the ground and were about one foot high. In summer, they run up to the top of the rank grass that grows around them, perhaps quite two feet. I succeeded in making out the following trees:—

15 Austrian Pine—*Pinus Laricio nigricans.*

5 Mountain Pine—*Pinus montana.*

16 Scotch Pine—*Pinus sylvestris.*

12 Maritime Pine—*Pinus pinaster* = *Pinus maritimus*, five of which grew from seed.

2 Norway Spruce—*Abies excelsa.*

1 Black Spruce—*Abies nigra.*

At No. 3 Station, I found planted in a small enclosure, about 15 feet square, and boarded up 5 feet high, specimens of Matrimony vine, *Lycium Europæum*. One root had been planted and it had spread over half the space in the enclosure and was a little lower than the top of the fence. This was quite luxuriant in growth and shoots were up through the sod several feet from the parent bush.

At the plantation known as Gourdeau Park where the larger part of the trees were put—a large basin-like depression which afforded some shelter from the wind—nothing now remains except a few specimens of Scotch Broom, *Genista scoparia,* scarcely existing, about the size of the original plants.

In the little garden at the main station, which is somewhat sheltered, the following were found:—

1 Weigelia—*Diervilla rosea.*

3 Van Houtte's Spiræa—*Spiræa Van Houttei.*

8 Red Currants. These have produced small quantities of fruit.

3 Lilacs grown from seed. *Syringa vulgaris.*

3 Gooseberries. Have produced small quantities of fruit.

2 Blackberries. Have never fruited.

3 Raspberries. Produced a handful of fruit one year.

1 Pine, probably *Pinus Cembra,* about two feet broad and six inches high.

1 Japanese Rose, *Rosa rugosa;* grows profusely, never kills back; about 5 feet high.

1 American Elm; less than two feet high.

1 Manitoba Maple; less than two feet high. These grow up rapidly during the summer and kill back during winter.

In this garden spot, there is also a strawberry patch from the plants supplied in 1901, which yields good fruit and some years in abundance.

These are all the specimens alive from the planting of 1901, and, excepting the *Rosa rugosa* and *Lycium Europæum,* none of them can be said to be thrifty. In the planting of these trees, I have taken much interest and I had hoped that some of them might succeed, and I exceedingly regret that I have to make such an unfavourable report.'

VISITS TO THE BRANCH EXPERIMENTAL FARMS.

The first visit paid in 1909 to the Branch Experimental Farms was in June, when I left Ottawa on the 5th and went direct to Rosthern, Sask. There, arrangements were made for fencing the new Experimental Farm and the necessary implements and tools were obtained, suitable horses purchased, and a building for the superintendent contracted for. As this farm was in rather a weedy condition, most of the land was summer-fallowed to clean it. The planting of the farm, comprising shelter belts, orchards, &c., was early considered, quite a large collection of hardy trees and shrubs had been accumulated and preparations were made for carrying on a full line of experiments with grain and other crops.

Lacombe, Alta., was also visited at this time and the plots and fields of grain duly inspected. The grounds were very much beautified by the large additions made to the clumps and groups of hardy trees planted here. The crops were all looking well and the surroundings of this farm were very attractive.

Lethbridge, Alta., was next visited and a careful inspection made of the many crops under test, both irrigated and non-irrigated, a large proportion of which were looking remarkably well. The fields of alfalfa were green and luxuriant and the trees and many of the small fruits were very promising.

From June 20 to 22 were spent at Agassiz, B.C., which was during the season of cherries. They were just ripe, but the heavy rains which prevailed at the time

caused the fruit to swell and crack so that it was impossible to gather them in a marketable condition. The crops generally, especially the grain and root plots, were all looking well and the grounds were gay with roses, rhododendrons, azaleas and other choice flowers.

On the return journey, Indian Head, Sask., was visited June 29 and 30, and the crops found in excellent order. The fields of grain were very luxuriant and the growth at this time was very rapid and full of promise. The large groups of flourishing shrubs at this farm were very attractive, especially the lilacs, honeysuckles and caraganas.

The Experimental Farm for Manitoba at Brandon was visited on July 1 and 2, and, on a careful inspection, all the crops were found to be in a promising condition. The four-acre field of Marquis wheat, which at harvest time gave an average yield of fifty-two bushels to the acre, was a splendid example of spring wheat. The stock and horses at both the above farms were found to be in good condition.

Early in August, a visit was paid to the Experimental Farm for the Maritime Provinces, at Nappan, N.S., and the crops were found in good condition. The hay crop had yielded well. A visit was also paid at this time to the new Experimental Farm at Charlottetown, P.E.I., and a considerable amount of work planned.

The general condition of the crops, buildings, implements, horses and other stock at each of these several farms was most gratifying and reflected credit on the management.

MEETINGS AND CONVENTIONS ATTENDED.

On August 23, I left Ottawa for Winnipeg, where I attended the meetings of the British Association for the Advancement of Science. These were held from August 25 to Sept 2. The meetings were large and well attended, many distinguished men being present from foreign countries. A paper was presented by me during this meeting on the Development of the Dominion Experimental Farms, which appears in the pages of this report. At the close of this convention, I joined the excursion to Victoria and took charge of one of the Pullman cars, in which were the president and some other distinguished visitors, and travelled with them from Winnipeg to the coast to give information regarding the country and its agricultural possibilities.

I also attended the annual meeting of the American Association for the Advancement of Science, which was held in Boston from December 25 to January 2. This meeting afforded an opportunity of gaining much information with reference to scientific matters generally and especially in their bearing on agricultural progress. Many meetings were held daily until the adjournment on January 2.

On January 22, I visited Rochester, N.Y., to attend the annual meeting of the Western New York Horticultural Society where, in response to invitation, I addressed them, on January 26, on the subject of Agricultural Progress in the Canadian Northwest. The facts submitted were widely circulated through the press and thus closer attention was called to the great possibilities for further advances in agriculture in Canada.

ACKNOWLEDGMENTS.

I beg to acknowledge my indebtedness to all the members of the Experimental Farm staff for their kind co-operation in the various branches of work conducted at the Central Experimental Farm and at the Branch Farms throughout the Dominion. The present report gives evidence of their earnest efforts to render service to agriculture in their various spheres of labour.

I also tender sincere thanks to those members of the staff who have aided me in those branches of the work of which I have had personal charge; to the farm foreman for his careful supervision of the special tests of fertilizers on field crops and the records of the results taken; to the foreman of the distribution branch for his watchful care over the distribution of the samples of seed grain sent for trial to farmers in all parts of the Dominion; to the foreman in charge of the lawns and ornamental grounds at the Central Farm, for the taste and industry he has displayed, and to the foreman of the greenhouses for his careful management of the plants and shrubs under propagation, also for the useful work he has done in testing the vitality of seeds and in the taking of meteorological records. I desire also to bear testimony to the faithful service of my secretary. The employees also of all the farms have my thanks for the interest they have manifested in their work and the careful manner in which they have discharged their respective duties.

REPORT OF

THE DOMINION AGRICULTURIST

J. H. GRISDALE, B. AGR.

Dr. William Saunders, C.M.G.,
Director, Dominion Experimental Farms,
Ottawa.

Sir,—I have the honour to submit herewith reports upon the horses, cattle, sheep, swine and farming operations under my supervision during the past year.

I have to report a very successful year in the different lines of work in my division.

Weather conditions in 1909 were probably quite up to the average as favouring crop production in this part of Canada. The reports of the different fields show the beneficial effects of such fairly favourable weather in increasing crop returns as compared with the years 1906, 1907 and 1908.

The work in my division was, as usual, carried on with the efficient co-operation of the farm foreman, Mr. D. D. Gray, and the herdsman, Mr. Wm. Gibson. Mr. Meilleur continues to do good work in the dairy. In correspondence and clerical work I am indebted to Mr. L. Giguere for careful and intelligent co-operation.

During the year I have attended a large number of meetings in various parts of Canada in addition to my regular duties on the Central Experimental Farm.

From April 1, 1909, to March 31, 1910, 3,551 letters were received and 6,026 despatched by the Agricultural Division.

I have the honour to be, sir,

Your obedient servant,

J. H. GRISDALE.

Dominion Agriculturist.

LIVE STOCK.

The live stock now (April 1, 1910) occupying the different stables and pens under my charge include horses, cattle, sheep and swine.

HORSES.

The horses are kept for labour exclusively, although some experimental feeding is usually under way to gain some information as to the most economical methods of feeding work horses, as well as experiments to determine the comparative values of different foods as forage for same.

The horses are usually nineteen in number, made up of:—

Thirteen heavy horses of Clydesdale and Percheron blood.

Five heavy driving horses.

One light driver.

CATTLE.

There are representatives of four breeds of cattle, viz.: Shorthorn, Ayrshire, Guernsey and Canadian. There are besides a number of grade cattle and steers. The cattle are kept for breeding and feeding operations, mostly of an experimental character. Pure-bred breeding animals are usually on sale, however, and a considerable number are sold in the course of the year.

PURE-BRED BREEDING CATTLE.

The pure-bred cattle in the barn at present are as follows:—

Twenty-six Shorthorns, including 3 bulls and 23 females.

Twenty-nine Ayrshires, including 1 bull and 28 females.

Eighteen Guernseys, including 3 bulls and 15 females.

Twenty-nine Canadians, including 6 bulls and 23 females.

GRADE CATTLE.

At present the grades number 19 head, made up of 3 Shorthorn grades, 5 Ayrshire grades, 6 Guernsey grades and 5 Canadian grades.

STEERS.

Twenty-two steers are under feed at present. They are of different ages and breeding, and the number is made up of 9 yearlings and 13 calves.

SHEEP.

Sheep are not kept in large numbers, only 62 being now in the pens. Two breeds are kept, namely: Shropshire and Leicester.

There are 38 Shropshires, as follows: One aged ram, 8 ram lambs, 20 aged ewes and 9 ewe lambs.

There are 8 Leicesters, as follows: Seven ewes and one ram.

Besides the above pure-breds there were 16 grade wethers.

SWINE.

Sixty-five swine of all classes are now in the pens, being fed experimentally, or being kept for breeding purposes. The breeds kept are Berkshire, Yorkshire and Tamworth.

The Yorkshires are 37 in number, including 2 stock boars, 29 breeding sows and 6 young pigs.

The Berkshires are 12 in number, including stock boar, 9 breeding sows and 2 young pigs.

The Tamworths are 13, including 1 stock boar, 9 breeding sows and 3 young pigs.

Three cross-bred barrows.

HORSES.

There are usually 19 horses in the stables. These horses are expected to do the work in the various divisions during the year. The work on the '200-acre farm' is but a part of their duties. They work iu addition for the horticultural and cereal divisions, as well as upon lawns and in the arboretum. In addition, a large amount of hauling or cartage in connection with the differeut divisions, as well as road making and messenger service, takes up much of their time.

HORSE LABOUR.

During the year, from April 1, 1909, to March 31, 1910, the work done by the 19 horses kept in the stables here was equivalent to 5,604·4 days' work, distributed as follows: Live stock, hauling feed, marketing stock, &c., 131·2 days; farm work, '200-acre farm,' 776·3 days; draining and care of roads, including removing snow and breaking roads in winter, 155·3 days; manure on '200-acre farm,' 322·7 days; horticultural division, 718 days; lawns, &c., 171·3 days; cereal division, 574·4 days; bulletins and reports, from and to farm offices, 140·1 days; poultry, 44·5; mail, including milk delivery, 99·1 days; omnibus service, including one horse for omnibus, two horses for general driving and horse for supervision of work, 1,650 days; work about green house, outbuildings, sidewalks, exhibitions, &c., 821·5 days.

In estimating the cost of farming operations further on in this report, $3 a day is charged for team and driver. To feed and care for the horses cost about 35 cents per horse per workiug day, and the driver receives an average of about $1.75 per 10-hour day. It is evident, therefore, that the team and driver costs about $2.45 per day, leaving a margin of 55 cents or 27·5 cents per horse per day for wear and tear.

THE STABLES.

The horse barn, built in 1906, and of which a description appears in the report for 1907-08, has proven very satisfactory.

Of the two systems of ventilation installed and possible of operation therein, 'The King' and 'The Rutherford,' the latter has proven to be much the more efficient and sanitary. With three inlets and two outlets this system keeps the air constantly renewed and in good condition without lowering the temperature beyond the point of comfort. The walls and ceilings have never shown any signs of dampness, hence the opinion that it is more sanitary. It has been found, however, that it is necessary to control the air currents at the points of intake rather than at the outlets if best results are to be hoped for.

The abundance of light has proven apparently very acceptable and beneficial.

The feeding chutes, after three years' trial, are still in use and are much liked by the men doing the actual feeding.

The cement floors, looked upon with suspicion by many horsemen when first laid, have been found safe, hygienic and durable. No injury has been traceable, directly or indirectly, to these floors although in use for three years. The stable can be kept absolutely free from unpleasant odours, an impossibility where wooden floors are used. The stalls, although showing some wear in certain cases, appear to be quite remarkably durable and will probably last a good number of years.

FEEDING THE WORK HORSES.

The horses here are fed by one man. Each teamster is responsible for the cleaning of his horses and harness, but has nothing to do with the feed.

Generally speaking, the horses are fed on mixed hay, given long, oats and bran, about 5 parts of whole oats to 2 parts of bran. These two are mixed and fed dry. On Saturday nights a bran mash of 5 or 6 lbs. per horse takes the place of the regular oat and bran mixture. When horses are on very heavy work, the ratio between oats and bran is usually changed to 5 of oats and 1 of bran. The horses receive from 1 to 1¼ lbs. of the oat and bran mixture and about 1 lb. of hay a day for each 100 lbs. of their weight. That is to say, a 1,600-lb. horse would get from 16 to 20 lbs. of grain mixture and about 16 lbs. of hay each day. The amount of grain or grain mixture fed depends upon the work being performed. The harder the work, the larger the amount of meal fed. That is, of course, subject to change, according to the health of the animals and various other minor considerations, such as degree of fatigue at night, temperature, &c.

The feeding of the horses follows regular lines and is done at regular hours. The first feed for the day is given about 5 a.m. It consists of about three-eighths of the total amount of meal or grain mixture to be fed during the day and about one-quarter of the hay. The noon feed is about the same thing. The evening feed consists of about one-quarter or two-eighths of the meal or grain mixture for the day and about one-half the hay.

Water is given between 6 and 7 in the morning, at noon, at 6 o'clock, or as the horses come in from work, and in winter at about 8 p.m. The water is given at 8 o'clock at night in the winter for the reason that the horses come in an hour earlier at night and go out an hour later in the morning.

EXPERIMENTS IN HORSE FEEDING.

Each year more or less experimental work is carried on in horse feeding. During the winter, 1909-10, some work was carried on to determine, if possible, whether it was safe and possible to substitute corn or barley for oats in feeding working horses.

The following tables show the results obtained:—

LOT 1.—FOUR HORSES ON MIXTURE, BARLEY 5 PARTS, BRAN 2 PARTS.

Name of horse.	Ration.	First weight Dec. 8, 1909.	Amount of grain consumed.	Weight, Dec. 21, 1909.	Amount of grain consumed.	Weight, Jan. 4, 1910.	Amount of grain consumed.	Weight, Jan. 18, 1910.	Amount of grain consumed.	Last weight, Feb. 1, 1910.	Gain or loss per horse in 8 weeks.	Amount of grain mixture consumed in 8 wks.
Tom....... ...	Barley, 5 and Bran, 2	1,605	160	1,620	160	1,620	163	1,615	168	1,595	L. 10	651
Barney..........	"	1,330	159	1,295	148	1,300	161	1,330	168	1,330	Nil	636
Frank......... ..	"	1,525	Sick	1,505	160	1,520	163	1,540	168	1,490	L. 35	491
Britt.......	"	1,635	159	1,635	135	1,640	148	1,625	168	1,620	L. 15	610
Aggregate.......	"	6,095	478	6,055	603	6,080	635	6,110	672	6,035	L. 60	2,388
Average per horse	"	1,523¾	119½	1,513¾	150¾	1,020	158¾	1,527½	168	1,508¾	L. 15	597

LOT 2.—FOUR HORSES ON MIXTURE, CORN 5 PARTS, BRAN 2 PARTS.

Name of horse.	Ration.	First weight Dec. 8, 1909.	Amount of grain consumed.	Weight, Dec. 21, 1909.	Amount of grain consumed.	Weight, Jan. 4, 1910.	Amount of grain consumed.	Weight, Jan. 18, 1910.	Amount of grain consumed.	Last weight, Feb. 1, 1910.	Gain or loss per horse in 8 weeks.	Amount of grain mixture consumed in 8 wks.
Ned.......	Corn, 5 and Bran, 2	1,555	166	1,555	160	1,550	167	1,545	200	1,540	L. 15	693
Bob......... ...	"	1,560	150	1,570	160	1,560	167	1,555	186	1,540	L. 20	663
Frank...........	"	1,370	161	1,365	160	1,380	165	1,350	186	1,395	G. 25	654
Doll.	"	1,480	139	1,470	133	1,470	145	1,425	167	1,435	L. 45	584
Aggregate	"	5,965	616	5,955	613	5,960	644	5,875	721	5,910	L. 55	2,594
Average per horse	"	1,491¼	154	1,488¾	153¼	1,490	161	1,468¾	180¼	1,477½	L. 13¾	648½

LOT 3.—FOUR HORSES ON MIXTURE, OATS 5 PARTS, BRAN 2 PARTS.

Name of horse.	Ration.	First weight Dec. 8, 1909.	Amount of grain consumed.	Weight, Dec. 21, 1909.	Amount of grain consumed.	Weight, Jan. 4, 1910.	Amount of grain consumed.	Weight, Jan. 18, 1910.	Amount of grain consumed.	Last weight, Feb. 1, 1910.	Gain or loss per horse in 8 weeks.	Amount of grain mixture consumed in 8 wks.
Star	Oats, 5 and Bran, 2	1,380	199	1,375	163	1,365	165	1,375	168	1,380	——	695
Dan....	"	1,350	199	1,340	163	1,360	165	1,375	168	1,580	G. 30	695
Frank...........	"	1,500	221	1,540	193	1,560	202	1,590	201	1,600	G. 100	817
Pete	"	1,540	218	1,555	193	1,570	202	1,590	201	1,585	G. 45	814
Aggregate......	"	5,770	837	5,810	712	5,855	734	5,930	738	5,945	175	3,021
Average per horse	"	1,442½	209¼	1.452½	178	1,463¾	182½	1,482½	184½	1,486¼	43¾	755¼

From a study of the above experimental data, it would appear that corn and barley could be substituted for oats, but the horses did not like either one as well as oats. The barley-fed horses seemed to really dislike the barley, more particularly at first, and one of them was off feed for a few days apparently for no other reason than a dislike of his grain ration.

DAIRY CATTLE.

The herd of dairy cattle during the year 1909-10 consisted of 65 milch cows all told. They were:—

Ayrshires	14
Guernseys	9
Canadians	16
Shorthorns	12
Grades (various breeding)	14

FEEDING THE DAIRY COWS.

The year 1909-10 has been a fairly satisfactory year from the dairy farmers' point of view. In this district, grass was exceedingly slow in starting, but growth was luxuriant once the weather became favourable. The months of August and early September were, as usual, dry and forage was rather short, but later conditions were exceedingly favourable.

SUMMER FEEDING.

As during the previous three years, the dairy cattle were allowed only a small area for pasture. They depended very largely upon soiling crops and corn silage.

A regular succession of crops was planned to supply the necessary forage.

A fourteen-acre field was available for pasture for 50 head. This field had been seeded down the previous year with the following mixture of seed per acre: Red clover, 5 lbs.; alfalfa, 7 lbs.; timothy, 10 lbs.

This seeding made such a strong growth in late May and early June that it was decided to divide the field, pasture the cattle on one-half and cut the other part for soiling purposes. This proved to be a very satisfactory plan and enabled us to materially increase the carrying power of the field.

For August, provision had been made by holding over a supply of corn ensilage. This material was fed more or less every day during the summer. During August, however, it formed the staple part of the ration. In September, grass was again plentiful, so very materially lessened the quantity of forage required to supplement the grass.

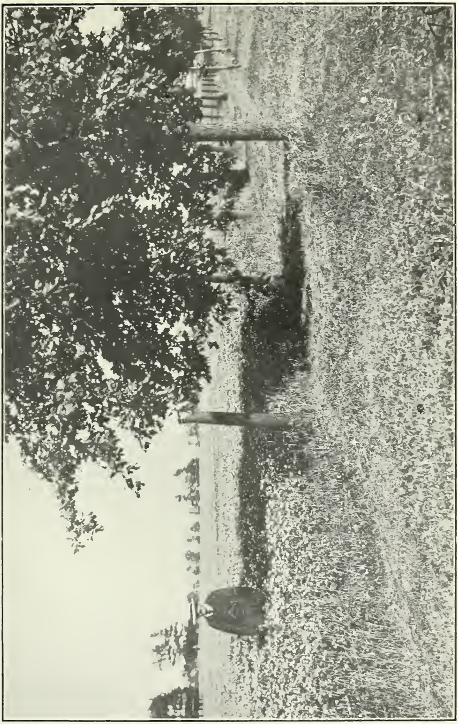
Practically all farmers require more or less feed to supplement pasture grass, unless the area down to grass is, relative to the number of cattle, very large. Corn silage is, no doubt, for most parts of Canada, the best forage to use for such a purpose.

In many cases, however, silos are not yet in use, and for such farmers a good plan would be to make use of the information contained in a 'Notice' or leaflet of instruction sent out very largely from this division the last few years, a copy of which appears below.

NOTICE FROM THE EXPERIMENTAL FARM TO DAIRY FARMERS.

Every year every dairy farmer loses much money on account of the scarcity of grass or by reason of the unprofitably large area of land that has to be used to insure good pasture during the months of July and August.

If the aveage dairy herd is to be profitable, every cow must be kept up to her full capacity during those two months, as well as during the preceding and succeeding months.



Clover Crop—Central Experimental Farm.

Photo by F. T. Shutt.

The quantity of milk produced during September, October and November is very materially influenced by the way in which the cattle are fed in July and August.

Cows receiving insufficient food during those two months naturally decrease very rapidly in milk flow. Once the milk yield is materially decreased for any considerable length of time, it cannot during that season be again brought up to what it might otherwise have been.

Hence, although pastures are usually good or feed plentiful during the months of September, October and November, when prices for cheese and butter are high, we must, in order to get the full benefit of these high prices and abundant supplies of feed, have been feeding well during the months of July and August.

The cheapest, easiest and most certain plan of insuring an abundance of food during the months of July and August is to make use of soiling crops.

Experiments at the Experimental Farm as well as elsewhere would seem to indicate vetches, peas, oats, clover and corn as the most suitable crops for the purpose.

For 10 Cows.

Dairy farmers are, therefore, recommended to prepare and feed somewhat as follows for each 10 cows in their herds:—

1. Clover, 1 acre—To have been sown with the mixture of peas and oats the previous year as described below.

Feed off June 20 to July 15.

2. Peas and oats, ½ acre—Sow 1 bushel peas, 1½ bushel oats and 5 lbs. red clover seed on one-half acre of land about the first week in May, or earlier if possible.

Feed off July 15 to 31.

3. Peas and oats, ½ acre—Sow same mixture on another half acre about third week in May.

Feed off August 1 to 15.

4. Corn, ½ acre.—Sow 10 lbs. Longfellow corn (or other small variety in hills 3 feet apart each way. Sow third week in May or as early as possible. Sow on well drained land, clover sod manured at rate of 20 loads (tons) per acre.

Feed off August 15 to 30.

5. Corn, ½ acre.—Sow 12 lbs. Leaming (or other medium variety) same way as above.

Feed off in September.

WM. SAUNDERS,
Director.

J. H. GRISDALE,
Agriculturist.

WINTER FEEDING.

The winter feeding was carried on under quite as favourable conditions as the summer. Feed was plentiful and of good quality. Cattle entered the barns in good flesh and have done well.

The winter ration has been on the average about as follows:—

Hay	5 lbs.
Corn ensilage	30 lbs.
Roots	15 lbs.
Straw	4 lbs.
Meal	7 lbs.

The hay was mixed red clover and timothy. The corn silage was of good quality, rich in grain and well preserved.

The roots were mangels, sugar mangels, sugar beets and turnips. They were usually pulped and mixed with the ensilage.

The straw was, of course, oat, and was of good feeding quality. It was cut and mixed with the pulped roots and ensilage.

The meal usually consisted of a mixture of 800 lbs. bran, 300 lbs. gluten and 200 lbs. oil-cake meal.

The meal was scattered on the roughage mixture of roots, ensilage and cut straw after it was before the cattle. The hay given was fed uncut, after the other material had been cleaned up.

Of course the amount of roughage fed depends on the appetite of the cow; the amount of meal is influenced rather by the amount of milk being produced by the cow in question.

Her meal ration is gradually increased after calving, until at three or four weeks in milk she is supposed to be on full feed. The amount of meal is judged by the milk produced. If she responds freely to the increases in meal, she is fed the more liberally, usually up to that point where an increase in meal does not seem to induce a relatively liberal increase in milk flow. One pound of meal for four pounds of milk is liberal feeding; one pound of meal for three pounds of milk, to leave a profit, necessitates selling milk at a higher price than the average farmer may hope for. In this connection it may be observed that the quality or composition of the meal ration is usually an important factor affecting the milk yield. It is exceedingly important, however, to remember that palatability in the meal as well as in the roughage is an influence that is not infrequently underestimated. Variety in meals fed is advisable, but variety should mean a blending of meals, not a substitution of one for another at frequent intervals. To illustrate, it is much better to feed a mixture of bran, oats, barley, oil-meal, gluten, cottonseed meal, &c., than to feed any one of them for a time, to be subsequently replaced by some other.

Generally speaking, the meal ration for dairy cows should be rich in protein, palatable, easily digested and fairly finely ground and blended to suit the roughage ration with which it is fed. Meals vary greatly as to composition and effect upon the digestive organs of the cattle. While some are laxative, some are constipating in effect, and while some seem to develop appetite, others have the opposite tendency.

COST OF FEEDING.

In estimating the cost of feeding, the following prices were charged for feed stuffs, being the average local market rates for the same during the season 1909, save in the case of ensilage and roots, which are charged for at the rate usually affixed in the experimental feeding in all parts of America.

Pasture per month	$ 1 00	per cow
Bran	20 00	per ton
Gluten meal	28 00	per ton
Oil meal	35 00	"
Oats	25 00	"
Barley	22 00	"
Clover hay	7 00	"
Chaff	4 00	"
Roots and ensilage	2 00	"

In estimating the value of the product, 26 cents per pound is allowed for the butter and 20 cents per 100 lbs. for the skim milk. The butter sells at from 25 to 35 cents per pound.

DAIRY HERD RECORDS.

The Central Experimental Farm dairy herd records as given below make a moderate showing. Where cattle are soiled, the cost of feeding during the summer months is of course increased, since more labour is necessary.

A study of the records shows a small number of cows that failed to pay for their feed. These, for the most part, are being disposed of to the butcher. Two or three of them are, however, being held over since they show promise of ultimately becoming profitable cows or made the bad showing on account of some accidental circumstance for which they could not be justly held responsible.

Names of Cows.		Age.	Date of dropping last calf.	Number of days in milk.	Daily average yield in milk.	Total milk for period.	Per cent fat in milk.	Pounds of butter produced in period.	Value of butter at 26 cents per pound.	Value of skim milk at 20 cents per cwt.	Total value of product.	Amount of meal eaten at 1¼ cent per lb.	Amount of roots, ensilage eaten at $2 per ton.	Amount of hay eaten at $7 per ton.	Amount of straw eaten valued at 20c. per cwt.	Months on pasture at $1 per month.	Total cost of feed for period.	Cost to produce 100 lbs. milk.	Cost to produce 1 lb. butter, skim milk neglected.	Profit on 1 lb. of butter, skim milk neglected.	Profit on cow during period, labour neglected.
		Yrs.			Lbs.	Lbs.	p. c.	Lbs.	$	$	$	Lbs.	Lbs.	Lbs.	Lbs.	Mos.	$	Cts.	Cts.	Cts.	
Marjorie	A.	8	Feb. 20, '10.	283	32·4	9,169	4·0	438·9	114·11	17·46	131·57	2,921	17,346	3,258	372	4	68·53	74·0	15·6	10·4	63·04
Queenie	G.G.	12	Jan. 23, '09.	359	16·9	6,050	6·1	434·61	113·00	11·23	124·23	2,715	15,861	4,589	372	4	62·23	102·0	14·3	11·7	62·00
Zamora	C.	14	" 17, '10.	334	23·6	7,873	4·6	431·64	112·23	14·88	127·11	2,827	15,813	3,300	372	4	65·98	83·0	15·2	10·8	61·13
Inoquette	C.	6	Mar. 17, '09.	365	20·6	7,524	4·5	390·56	101·54	14·27	115·81	2,703	15,271	2,252	372	4	60·30	80·0	15·4	10·6	55·49
Denty	A.	11	" 13, '09.	334	25·8	8,635	3·9	395·74	101·89	16·48	118·37	2,619	16,310	3,195	372	4	63·66	73·0	16·0	10·0	54·71
La Belle	C.	5	" 17, '10.	319	21·9	6,998	4·7	390·20	101·45	13·22	114·67	2,666	15,861	3,260	372	4	63·99	91·0	16·4	9·6	50·68
Dolly	G.A.	7	" 30, '10.	306	27·2	8,324	3·6	355·10	92·33	15·93	108·26	2,566	16,382	2,596	372	4	60·99	73·0	17·1	8·9	47·27
Maggie of C	A.	2	May 2, '09.	304	28·2	8,600	3·7	373·34	97·06	16·45	113·51	2,913	17,131	3,198	342	4	67·95	79·0	18·2	7·8	45·56
Duchess 2eme	C.	5	Mar. 26, '09.	365	16·4	5,980	5·2	369·95	96·19	11·22	107·41	2,641	15,675	3,230	372	4	63·40	106·0	17·1	8·8	44·01
Flavia	A.	8	May 13, '09.	298	25·4	5,579	3·8	339·91	88·37	14.47	102·84	2,484	16,260	2,644	372	4	60·05	79·0	17·6	8·4	42·79
Ottawa Itchen	G.	4	Oct. 30, '09.	304	26·0	6,279	4·7	353·08	91·80	11·85	103·65	2,891	15,930	2,581	372	4	64·49	102·0	18·2	7·8	39·16
Flavia II	A.	4	" 28, '09.	276	26·3	7,277	3·8	326·85	84·98	13·09	98·88	2,754	16,029	2,586	341	4	62·84	86·0	19·2	6·8	36·04
Deanie	G.	11	Aug. 9, '09.	262	22·2	5,832	4·6	317·17	82·20	11·03	93·23	2,386	15,770	2,441	372	4	57·68	98·0	18·2	7·8	35·55
Whitie	S.G.	6	Mar. 12, '10.	293	24·3	7,123	3·8	321·33	83·54	13·60	97·14	2,603	17,286	2,848	372	4	63·21	88·0	19·6	6·4	33·93
Illuminata III	S.	6	Oct. 18, '09.	288	27·6	7,935	3·7	345·15	89·74	13·18	102·92	3,057	18,292	2,802	372	4	69·51	88·0	20·1	5·9	33·41
Alma II	G.G.	4	Sept. 30, '09.	304	18·4	5,607	4·8	320·01	83·20	10·57	93·77	2,623	15,640	2,600	372	4	60·96	108·0	19·0	7·0	32·81
Dora	G.G.	7	May 30, '09.	245	19·4	4,752	5·2	290·56	75·55	8·92	84·47	1,888	15,381	2,605	372	4	51·89	109·0	17·8	8·2	32·58
Marjorie II	A.	4	July 24, '09.	330	20·3	6,711	4·1	326·70	84·94	12·07	97·71	2,725	16,412	3,235	372	4	65·17	97·0	19·2	6·1	32·54
Ott. Marchioness III.	S.	4	Apl. 1, '09.	365	17·7	6,460	4·1	315·34	81·99	12·29	94·28	2,548	16,921	2,767	372	4	61·91	95·0	18·6	6·4	32·37
Dona Clatina	G.	3	Sept. 6, '09.	181	27·0	3,755	4·8	212·89	55·35	7·08	62·43	1,483	9,220	941	1	....	30·31	80·0	14·2	11·8	32·12
Fortune	C.	13	Apl. 29, '09.	327	19·6	6,411	4·2	319·53	83·08	12·18	95·26	2,605	15,844	3,260	372	4	63·24	98·0	19·7	6·3	32·02
Denty III	A.	4	" 4, '09.	296	23·4	6,934	3·8	311·20	80·91	13·25	94·16	2,701	16,247	3,211	372	4	64·63	93·0	20·7	5·3	29·53
Molly	S.	8	Feb. 10, '10.	309	23·0	7,117	3·7	311·66	81·03	13·61	94·64	2,741	17,755	2,781	370	4	65·11	91·0	20·9	4·1	29·53
Kate	A.	3	Oct. 4, '09.	178	25·1	4,478	3·8	204·56	53·18	8·54	61·72	2,649	9,399	929	.....	....	32·44	72·0	15·8	10·2	29·28
Alma	G.G.	9	July 24, '09.	272	20·0	5,441	4·5	286·59	74·51	10·31	84·82	2,027	16,466	3,170	371	4	56·61	104·0	19·7	6·3	28·21
Précoce	C.	3	Jan. 24, '09.	365	13·9	5,091	4·7	283·69	73·81	9·61	83·42	2,308	15,279	2,493	372	4	56·43	110·0	19·8	6·2	26·99
Gurta	A.	9	Feb. 1, '09.	365	15·1	5,515	4·0	263·20	68·33	10·50	78·93	2,163	14,232	2,479	372	4	53·60	97·0	20·3	5·7	25·35
Maggie V	A.	4	May 5, '09.	323	18·9	6,115	4·0	287·76	74·82	11·65	86·47	2,533	15,799	3,139	372	4	61·90	101·0	21·5	4·5	24·57
Soucy R	A.	5	....	182	18·8	3,433	4·0	163·94	41·62	6·54	49·16	1,056	9,691	940	.....	...	25·65	74·0	15·6	10·4	23·51
Fanny	G.C.	5	Feb. 5, '10.	318	16·1	5,147	4·5	274·48	71·36	9·74	81·10	2,376	16,360	2,549	372	4	58·53	113·0	21·3	4·7	22·57
Itchen Lady	G.	12	Jan. 1, '10.	270	24·6	6,656	4·3	340·79	68·61	12·63	81·24	2,440	15,755	2,711	372	4	59·24	89·0	17·4	8·6	22·00
Duchess of V	S.	5	Feb. 26 '10.	275	22·5	6,205	3·9	288·42	74·88	11·83	86·71	2,711	17,783	2,763	372	4	64·71	104·0	22·4	3·6	21·90

Denty III	A.	5	May 13, '09.	312	18·0	5,624	4·2	281·81	73·27	10·68	83·95	2,507	16,270	3,209	372	4	62·32	118·0	22·1	3·9	21·57
Pearly Prize.........	G.	5	Feb. 10, '10.	263	18·1	4,761	4·7	264·89	68·87	8·99	77·86	2,304	15,680	2,745	372	4	57·67	120·0	21·7	4·3	20·19
Illuminata V........	S.	3	Oct. 15, '09.	182	22·2	4,052	3·6	173·43	45·09	7·55	52·84	1,581	11,477	1,097	....	....	34·28	84·0	19·7	6·3	18·56
Réjane	C.	6	" 22, '09.	283	16·7	4,742	4·8	270·41	70·31	8·94	79·25	2,591	15,418	2,700	372	4	60·71	121·0	24·4	3·6	18·54
Duchesse...........	C.	6	Apl. 15, '09.	271	22·0	5,978	3·8	262·34	68·21	11·43	79·64	2,447	15,891	3,270	372	4	61·43	102·0	23·4	2·6	18·21
Poupée...........	C.	7	Feb. 2, '09.	275	19·8	5,447	4·1	265·16	68·94	10·36	79·30	2,456	15,776	3,400	372	4	61·88	114·0	23·3	2·7	17·42
Duchesse Perdue	C.	4	May 8, '09.	304	14·9	4,525	4·1	219·98	57·19	8·61	65·80	1,951	12,732	2,377	112	4	48·68	107·0	22·1	3·9	17·12
Janet...............	S.	10	Mar. 24, '10.	235	22·6	5,323	4·0	254·07	66·05	10·13	76·18	2,292	17,233	2,780	372	4	59·20	111·0	23·3	2·7	16·98
Ottawa Spot.........	G.	5	Jan. 14, '09.	183	19·7	3,613	4·3	186·87	45·58	6·85	52·43	1,678	6,510	1,410	372	4	36·23	100·0	19·3	6·7	16·20
Aromaz	C.	3	" 4, '10.	82	23·0	1,890	4·6	104·30	27·12	3·57	30·69	718	5,010	419	.....	...	15·09	79·0	14·4	11·6	15·60
Bessie........	G.A.	3	Sept. –, '09	181	16·0	2,908	3·7	128·28	33·35	5·56	38·91	968	9,361	947	.....	....	24·28	86·0	18·8	7·2	14·63
Duchesse V..........	C.	3	Oct. 2, '09.	298	18·0	5,370	4·0	254·20	66·09	10·23	76·32	2,700	15,453	2,700	372	4	62·05	115·0	24·4	1·6	14·27
Jessie D	A.	4	May 21, '09.	319	14·8	4,752	3·9	221·93	57·70	9·06	66·76	2,022	13,686	3,035	100	4	52·76	111·0	23·7	2·3	14·00
Soncy.............	A.	4	Mar. 28, '10.	306	19·0	5,795	3·6	242·75	63·11	11·10	74·21	2,471	16,172	3,204	372	4	61·77	106·0	25·4	·6	22·44
Ottawa Lass	S.	8	Feb. 12, '10.	257	20·0	5,163	3·6	220·36	57·29	9·89	67·18	1,957	17,316	2,747	372	4	55·14	106·0	25·0	1·0	12·04
Inoquette III.	C.	2	Jan. 8, '10.	77	22·2	1,714	4·0	86·66	20·97	3·26	24·23	609	3,875	367	....	....	12·46	72·0	18·4	7·6	11·77
Ruby...............	G.	12	Feb. 4, '10.	266	17·8	4,740	4·2	234·27	60·91	9·01	69·92	2,308	16,472	2,745	372	4	58·50	123·0	24·9	1·1	11·42
Deanie II.....	G.G.	2	Nov. 30, '09.	120	16·6	1,998	4·1	97·41	25·33	3·80	29·13	857	5,905	562	.....	..	18·15	90·0	18·6	7·4	10·98
Jessie E............	A.	9	Jan. 30, '09.	365	13·6	4,948	3·7	211·15	54·90	9·47	64·37	2,239	13,542	2,479	372	4	53·82	108·0	25·0	1·0	10·55
Fortune 4eme..... .	C	3	Feb. 15, '10.	317	15·0	4,758	4·0	226·73	58·94	9·06	68·00	2,407	15,488	2,503	372	4	57·82	121·0	25·5	·5	10·18
La Belle II.........	C.	2	Oct. 17, '09.	160	11·2	1,800	4·5	96·76	25·16	3·40	28·56	749	8,101	821	....	....	19·96	110·0	20·6	5·4	8·60
Ott. Marchioness II..	S.	5	Dec. 14, '09	288	17·2	4,955	4·1	243·43	63·29	9·42	72·71	2,664	17,859	2,851	372	4	64·52	130·0	26·5	*·5	9·19
Illuminata IV.......	S.	4	Jan. 26, '09.	306	15·6	4,783	3·9	222·54	57·86	9·12	66·98	2,391	17,466	2,856	372	4	60·88	127·0	27·3	*1·3	6·10
Pearl's Redemption..	G.	5	" 15, '10.	222	15·4	3,412	5·0	202·16	52·56	6·42	58·98	2,092	15,352	2,745	372	4	54·79	160·0	27·1	*1·1	4·19
Robichaud.	C.	2	Feb. 20, '09.	334	11·6	3,900	4·0	187·74	48·81	7·42	56·23	2,102	14,107	2,479	372	4	52·73	135·0	28·0	*2·0	3·50
Ottawa Marchioness..	S.	7	May 23, '09.	304	13·2	4,032	4·0	192·19	49·96	7·67	57·63	1,951	17,165	2,767	372	4	54·99	136·0	28·6	*2·6	2·64
Queenie II...... ..	G.G.	2	Apl. 29, '09.	304	9·0	2,755	4·9	160·77	41·80	5·19	46·99	1,586	12,399	2,529	100	4	44·48	161·0	27·6	*1·6	2·51
Eva............ ..	G.C.	7	Aug. 10, '09.	224	14·0	3,155	4·3	161·12	41·89	5·99	47·88	1,755	12,683	2,214	372	4	46·23	146·0	28·6	*2·6	1·65
Jessica II....... ...	S.	9	May 4, '09.	355	11·2	3,985	3·9	185·15	48·14	7·60	55·74	2,190	15,121	2,563	372	4	55·11	138·0	29·7	*3·7	·63
Pearl.	G.	9	Sept. 30, '09.	299	10·8	3,190	5·2	197·40	51·32	5·99	57·31	2,539	15,893	2,601	372	4	60·21	188·0	30·5	*4·5	* 2·90
Molly II....... .	S.	8	Feb. 10, '10.	237	12·7	3,026	4·2	150·85	39·22	5·75	44·97	2,068	17,690	2,707	372	4	56·71	187·0	37·5	*11·5	*11·74
Dora II.....	G.G.	..	Mar. 13, '10.	228	9·2	2,111	5·2	129·77	33·74	3·96	37·70	1,877	14,740	2,595	372	4	51·09	242·0	39·3	*13·3	*13·39
Zaza.	C.	4	Oct. 2, '09.	172	12·0	2,071	4·5	110·03	28·61	3·92	32·53	1,848	13,013	2,462	372	4	48·55	234·0	44·1	*18·1	*16·02

Loss.

CANADIANS.

Names of Cows.	Age.	Date of dropping last calf.	Number of days in milk.	Daly average yield in milk.	Total number for period.	Per cent fat in milk.	Pounds of butter produced in period.	Value of butter at 26 cents per pound.	Value of skim milk at 20 cents per 100 lbs.	Total value of product.	Amount of meal eaten at 1¼ cent per lb.	Amount of roots and ensilage eaten at $2 per ton.	Amount of hay eaten at $7 per ton.	Amount of straw eaten at 20 cents per cwt.	Total cost of feed for period.	Cost to produce 100 lbs. of milk.	Cost to produce 1 lb. butter, skim milk neglected.	Profit on one pound butter, skim milk neglected.	Profit on cow during period, labour neglected.
Zanora	14	Jan. 17, '10.	334	23·6	7,873	4·6	431·64	112·23	14·98	127·11	2,827	15,813	3,300	372	65·98	83·0	15·2	10·8	61·13
Inquette	6	Mar. 17, '09.	365	20·6	7,524	4·5	390·56	101·54	14·27	115·81	2,703	15,271	2,252	372	60 30	80·0	15·4	10·6	55·49
LaBelle	5	" 17, '10.	319	21·9	6,998	4·7	390 20	101·45	13·22	114·67	2,666	15,861	3,260	372	63·99	92·0	16·4	9 6	50·68
Average	8		339	21·7	7,465	4·6	404·13	105·07	14·16	117 53	2,732	15,648	2,937	372	63·42	84·6	15·6	10·3	55·73

GRADES.

Names of Cows.	Age.	Date of dropping last calf.	Number of days in milk.	Daly average yield in milk.	Total number for period.	Per cent fat in milk.	Pounds of butter produced in period.	Value of butter at 26 cents per pound.	Value of skim milk at 20 cents per 100 lbs.	Total value of product.	Amount of meal eaten at 1¼ cent per lb.	Amount of roots and ensilage eaten at $2 per ton.	Amount of hay eaten at $7 per ton.	Amount of straw eaten at 20 cents per cwt.	Total cost of feed for period.	Cost to produce 100 lbs. of milk.	Cost to produce 1 lb. butter, skim milk neglected.	Profit on one pound butter, skim milk neglected.	Profit on cow during period, labour neglected.
Queenie	12	Jan. 23, '09.	359	16·9	6,050	6·1	434·61	113·00	11·23	124·23	2,715	15,861	2,589	372	62·23	102·0	14·3	11·7	62 00
Dolly	7	Mar. 31, '10.	306	27·2	8,324	3·6	355·10	92·33	15·93	108·26	2,566	16,382	2,596	372	60·99	73·0	17·1	8·9	47 27
Whitie	6	" 12, '10.	293	24·3	7,123	3 8	321·33	83·54	13·60	97·14	2,603	17,281	2,848	372	63·21	88·0	19·6	6·4	33·93
Average	8		319	22·8	7,165	4·5	370·31	96·29	13·58	109·87	2,628	16,508	2,644	372	65·47	87·6	17 0	9·0	47·73

SHORTHORNS.

Names of Cows.	Age.	Date of dropping last calf.	Number of days in milk.	Daly average yield in milk.	Total number for period.	Per cent fat in milk.	Pounds of butter produced in period.	Value of butter at 26 cents per pound.	Value of skim milk at 20 cents per 100 lbs.	Total value of product.	Amount of meal eaten at 1¼ cent per lb.	Amount of roots and ensilage eaten at $2 per ton.	Amount of hay eaten at $7 per ton.	Amount of straw eaten at 20 cents per cwt.	Total cost of feed for period.	Cost to produce 100 lbs. of milk.	Cost to produce 1 lb. butter, skim milk neglected.	Profit on one pound butter, skim milk neglected.	Profit on cow during period, labour neglected.
Illuminata III	6	Oct. 18, '09.	288	27·6	7,935	3·7	345·15	89·74	13·18	102·92	3,057	18,292	2,802	372	69·51	88·0	20·1	5·9	33·41
Ottawa Marchioness III	4	Apl. 1, '09.	365	17·7	6,460	4·1	315·34	81·99	12·29	94·28	2,548	16,921	2,767	372	61·91	95·0	19·6	6·4	32 37
Molly	8	Feb. 10, '10.	309	23·0	7,117	3·7	311·66	81·03	12·61	94·64	2,741	17,755	2,781	370	65·11	91·0	20·9	5·1	29·53
Average	6		320·6	22·7	7,170	3·8	324·05	84·25	13 02	97·28	2,782	17,656	2,783	371	65·51	91·3	20 6	5·8	31·77

AYRSHIRES.

Marjorie	8	Feb. 20, '10.	283	32·4	9,169	4·0	438·09	114·11	17·46	131·57	2,921	17,346	3,258	372	68·53	74·0	15·6	10·4	63·04
Denty	11	Mar. 13, '09.	334	25·8	8,635	3·9	395·74	101·89	16·48	118·37	2,619	16,310	3,195	372	63·66	73·0	16·0	10·0	54·71
Maggie of C.	12	" 2, '09.	304	28·2	8,600	3·7	373·34	97·06	16·45	113·51	2,913	17,131	3,198	342	67·95	79·0	18·2	7·8	45·56
Average	10		307	28·8	8,801	3·8	402·39	104·35	16·79	121·15	2,817	16,929	3,217	361	66·71	75·3	16·6	9·4	54·43

GUERNSEYS.

Ottawa Itchen	4	Oct. 30, '09.	304	26·0	6,279	4·7	353·08	91·80	11·85	103·65	2,891	15,930	2,581	372	64·49	102·0	18·2	7·8	39·16
Deanie	11	Aug. 9, '09.	262	22·2	5,832	4·6	317·17	82·20	11·03	93·23	2,386	15,770	2,441	372	57·68	98·0	18·2	7·8	35·55
Dona Clatina	3	Sept. 6, '09.	181	27·0	3,755	4·8	212·89	57·35	7·08	62·43	1,483	9,220	941	–	30·31	80·0	14·2	11·8	32·12
Average	6		249	25·0	5,288	4·7	294·38	77·11	9·98	86·43	2,253	10,306	1,987	248	50·82	93·3	16·8	9·1	35·63

DAIRY COW RECORDS.

KEEPING RECORDS.

An increasingly large number of dairy farmers avail themselves of the offer made by this division to supply, free of cost, forms whereon to keep record of the milk produced each day, or one day in each week, by each cow. This fact points to progress along right lines. It is only when one knows the individuals in one's herd that one can hope to improve the general quality of the herd.

The forms supplied are for week-long periods, as illustrated below, or for month-long periods, as may be preferred by the dairymen. In addition, forms for summarizing the month's work, as well as forms whereon to enter up the year's record, are sent on application.

DAILY MILK RECORD.

Herd belonging to..................................
Post office ....
Record for week ending....... ....

(This form supplied free by Live Stock Division, Central Experimental Farm, Ottawa, Ont.)

COWS.

Day.	Time.																	Total for day.
Sunday...........	Morning......																	
	Evening......																	
Monday..........	Morning.....																	
	Evening......																	
Tuesday..........	Morning......																	
	Evening......																	
Wednesday..... .	Morning......																	
	Evening.... .																	
Thursday.........	Morning......																	
	Evening......																	
Friday.	Morning......																	
	Evening......																	
Saturday..........	Morning......																	
	Evening																	
Total.........	Week........																	

(Reverse.)

CENTRAL EXPERIMENTAL FARM.

Wm. Saunders, Director. J. H. Grisdale, Live Stock and Agriculture.

MILK RECORDS.

1. The profitable dairy cow must give over 5,000 pounds of milk each year. To know the value of a cow, her total annual yield of milk must be known. The only way to know this is to keep a record of her daily milk yield.

2. The form on the other side of this sheet is intended to help progressive dairy farmers by supplying them with a simple and convenient sheet for the keeping of the milk record of their individual cows. A study of such records will soon indicate which cows should go to the butcher. We would be pleased to receive a summary of your record. If you have no summary forms, write us.

3. Such records are being kept by hundreds of successful dairymen to-day. Many of these men attribute their success to the keeping of such records. Why not give the

thing a trial, if you are a dairyman? It will increase your milk product. It will lighten your labour since your interest will be increased in your work and 'interest lightens labour.' It will show you the unprofitable cow, the 'boarder.' You cannot get rid of her too quickly.

4. For weighing the milk a simple spring balance may be secured for from one and a half to four dollars. If your local dealer cannot supply you, write the undersigned for particulars. A small platform scale is fairly convenient, but we find the spring balance preferable.

5. Many farmers keep records of the amount of food fed to individual cows. If you would like to do so, sample forms would be sent free on writing to J. H. Grisdale, Agriculturist, Central Experimental Farm, Ottawa, Ont.

DAIRY COW FEEDING EXPERIMENTS.

All cattle in the barns are under experiment to a greater or lesser extent. All cattle are not necessarily in comparative tests, but a record is kept of the methods of feeding and of quantities given each animal. Results are noted and conclusions drawn as to the values of different methods of feeding and different rations under certain conditions. Information gained in this way is difficult to disseminate directly, but is of great value as facilitating more intelligent handling of the live stock generally and the more efficient conducting of comparative feeding tests.

During the year two small experiments in comparative feeding have been conducted. In one case a test was made with three small groups of grade cows, far advanced in the lactation period, to gain some information as to the possibility of replacing the meal ration or some part thereof with mangels.

The second case was an experiment with five groups of cows, all far advanced in lactation, to gain, if possible, some information as to the comparative value of bran, alfalfa hay, dried beet pulp, beet and molasses meal or pulp, and an equal weight of a meal mixture made up of bran, 300 lbs.; shorts, 300 lbs.; gluten feed, 500 lbs., and peas, 100 lbs.

MANGELS VS. MEAL.

In this experiment the outline of the whole thing was as follows:—

First period, February 15-21, 1910.

Lot 1.—Alma, Fannie, Gurta.

Daily ration per cow.—Meal mixture, 1 lb. for each 3 lbs. milk produced; long straw, 3 lbs.; sorghum ensilage, 100 lbs.; cut straw, 16 lbs. What each cow would eat up clean.

Lot 2. —Soncie, Bessie, Jessie E.

Daily ration per cow.—Same as Lot 1.

Lot 3.—Queenie, Robichaud, La Belle.

Daily ration per cow.—Same as Lot 1.

Second period, February 22-March 7, 1910.

Lot. 1. Daily ration per cow.—Same as period 1.

Lot 2. Daily ration per cow.—Roughage, same as period 1; mangels, 3 lbs. for each pound milk produced; no meal.

Lot 3. Daily ration per cow.—February 22-28, roughage, same as period 1; meal, 1 lb. to 4 lbs. milk produced; mangels, ½ lb. to 1 lb. milk produced. March 1-7, meal, 1 lb. to 5 lbs. milk produced; mangels, 1 lb. to 1 lb. milk produced.

Third period, March 1-8, 1910.

Lot 1. Daily ration per cow.—Roughage, same as period 1; mangels, 3 lbs. to 1 lb. milk produced.

Lot 2. Daily ration per cow.—Same as period 1.

Lot 3. Daily ration per cow.—March 8-14, roughage, same as period 1; meal, 1 lb. to 6 lbs. milk produced; mangels, 1½ lb. to 1 lb. milk produced. March 15-21, Meal, 1 lb. to 7 lbs. milk produced; mangels, 2 lbs. to 1 lb. milk produced.

Meal mixture.—Bran, 500 lbs.; beet pulp, 200 lbs.; beet and molasses pulp, 200 lbs.; cottonseed meal, 100 lbs.

Cows weighed.—Monday, February 14, 10 a.m.; Tuesday, March 22, 10 a.m.

All feeds weighed closely for each cow each time fed.

The data given below are not of very great value, but should prove useful as a guide to future work and as an indication of the danger of depending too much on roots for cows far advanced in lactation.

DAIRY COW EXPERIMENT.

1909-10.	First Period of One Week.			Second Period of Two Weeks.			Third Period of Two Weeks.		
	All Groups Fed Alike.			All Groups Fed Alike.			All Groups Fed Alike.		
	Lot 1.	Lot 2.	Lot 3.	Lot 1.	Lot 2.	Lot 3.	Lot 1.	Lot 2.	Lot 3.
Number of cows in group	3	3	3	3	3	3	3	3	3
Average weight to start	1,007	766	699	1,012	764	811	1,015	743	813
Average weight at end of period	1,012	764	811	1,015	743	813	1,010	777	812
Loss − or gain +	+5	−2	+12	+3	−21	+2	−5	+34	−1
Meal fed group in 1 day	17·2	16·4	9·2	16·8	9	5·4	....	11·7	2·6
Sorghum ensilage fed group in 1 day { Sorghum, 100 lbs. / Cut straw, 16 " }	129	119	114	130·3	64·3	120	76·3	110	120
Roots fed group in 1 day	....	....	....	....	118·6	6	126	....	28·2
Long straw fed group in 1 day	9	9	9	9	9	9	9	9	9
Meal fed group during period	120·7	115·2	64·2	236	....	75·4	....	164·7	37·5
Sorghum ensilage fed group during period { Sorghum, 100 lbs. / Cut straw, 16 " }	900	830	795	1,825	901	1,680	1,070	1,540	1,680
Roots fed group during period	....	....	....	....	1,661	84	1,765	....	395
Long straw fed group during period	63	63	63	126	126	126	126	126	126
Value of feed fed group during period .... $	2·78	2·57	1·91	5·54	2·82	3·28	3·25	4·25	3·08
Value of feed fed 1 cow in 1 day .... c.	13·2	12·3	9·1	13·2	6·7	7·5	7·7	10·1	7·3
Milk produced by group during period .... lbs.	363	328	180	699	515	290	579	563	212
First week's milk from group .... "	....	....	....	351	277	153	312	247	118
Last week's milk from group .... "	....	....	....	348	238	137	267	256	94
Average daily yield of milk of group during 1st week	52·5	47	25.7	50	39·6	21·9	44·5	35·3	16·9
Average daily yield of milk of group during 2nd week	....	....	....	49·7	34	19·6	38·1	36·5	13·4
Decrease in rate of daily milk yield	....	....	....	·3	5·6	2·3	6·4	1·2	3·5
Decrease in quantity of milk produced by group from period 1 to last week in period 3	....	....	....	....	....	....	96	72	86
Rate per cent of decrease in 4 weeks .... p. c.	....	....	....	....	....	....	26	22	48

MIXED MEAL VS. DRIED BEET PULP.—BEET AND MOLASSES MEAL VS. ALFALFA HAY.—ALFALFA HAY VS. DRIED BEET PULP.—MIXED MEAL VS. BEET AND MOLASSES MEAL.

This experiment, undertaken in order to compare dried beet pulp, beet and molasses meal and alfalfa hay with wheat bran or mixed meal, the feeding qualities of the bran and mixed meal being known, is not conclusive, but seems to demonstrate the great value of wheat bran and mixed meal as compared with the other feeds under trial as concentrates.

Alfalfa shows up rather badly in comparison with the dried beet pulp and the beet and molasses meal. This is, however, due in some measure to the rather poor quality of alfalfa hay available during part of the experiment.

In this experiment, the outline of the whole thing was as follows:—

Lot 1.—Main row, Shorthorns (7.)

First period, four weeks—

Ensilage, straw, etc.. .. .. What they will eat.
Hay.. .. .. 4 lbs. each.
Mangels.. .. .. 8 lbs. each.
Meal.. .. .. 2 lbs. each and 1 lb. for each 4 lbs. milk produced.
Dried beet pulp.. .. .. 3 lbs.

Second period, four weeks—

Substitute 3 lbs. extra meal in place of dried beet pulp.

Lot 2.—Main row, Ayrshires (7.)

First period, four weeks—

Ensilage, straw, etc.. .. .. What they will eat.
Hay.. .. .. 4 lbs. each.
Mangels.. .. .. 8 lbs. each.
Meal.. .. .. 2 lbs. each, then 1 lb. for each 4 lbs. milk produced.
Beet and Molasses meal.. .. .. .. 3 lbs.

Second period, four weeks—

Substitute 3 lbs. alfalfa hay in place of beet and molasses meal.

Lot 3.—Main row, Guernseys (5.)

First period, four weeks—

Ensilage, straw, etc.. .. .. What they will eat.
Hay.. .. .. 4 lbs. each.
Mangels.. .. .. 8 lbs. each.
Meal.. .. .. 2 lbs. each, then 1 lb. for each 4 lbs. milk produced.
Wheat bran.. .. .. 3 lbs.

Second period, four weeks—

Same as first period.

Lot 4.—Main row, Canadians (9.)

First period, four weeks—

Ensilage, straw, etc..	What they will eat.
Hay..	4 lbs. each.
Mangels..	8 lbs. each.
Meal..	2 lbs. each, then 1 lb. for each 4 lbs. milk produced.
Alfalfa hay..	3 lbs. each.

Second period, four weeks—

Substitute 3 lbs. dried beet pulp in place of alfalfa hay.

Lot 5.—Small row, Ayrshires, Guernseys Facing (9.)

First period, four weeks—

Ensilage, straw, etc..	What they will eat.
Hay..	4 lbs. each.
Mangels..	8 lbs each.
Meal..	2 lbs. each per diem, and 1 lb. for each 4 lbs. milk produced. Regular meal mixture. 3 lbs. extra meal.

Second period, four weeks—

Substitute 3 lbs. beet and molasses meal in place of extra meal.

Meal Mixture.

Bran..	300 lbs.
Shorts..	300 "
Gluten feed..	500 "
Peas..	100 "

All feed weighed to groups. Started December 15.

The following table includes the more important data gathered from the work during the eight weeks the experiment lasted:—

EXPERIMENT WITH DIFFERENT CONCENTRATES FOR DAIRY COWS.

Group.	Group I.		Group II.		Group III.		Group IV.		Group V.	
Period.	First Period of 28 days.	Second Period of 28 days.	First Period of 28 days.	Second Period of 28 days.	First Period of 28 days.	Second Period of 28 days.	First Period of 28 days.	Second Period of 28 days.	First Period of 28 days.	Second Period of 28 days.
Special Feed Fed.	Dried Beet Pulp.	Extra Meal.	Beet Molasses Meal	Alfalfa.	Bran.	Bran.	Alfalfa.	Dried Beet Pulp.	Extra Meal.	Beet Molasses Meal
Number in group	7	7	7	7	5	5	9	9	6	6
Average weight to start ... Lbs.	1,292	1,342	1,066	1,083	952	954	964	1,005	859	858
Average weight at end of 4 weeks ... "	1,342	1,395	1,083	1,110	954	1,002	1,005	1,051	858	878
Loss— or gain+ ... "	+ 50	+ 53	+ 17	+ 27	+ 2	+ 48	+ 41	+ 46	— 1	+ 20
Meal fed group in 1 day ... "	38·26	30·6	37·34	35·3	27·7	24·3	43·9	46·2	42·5	39·5
Ensilage fed group in 1 day ... "	502	394	369	367	242	236	402	414	297	279
Hay fed group in 1 day ... "	28	28	28	28	20	20	36	36	24	24
Roots fed group in 1 day ... "	56	56	56	56	40	40	72	72	48	48
Dried Beet Pulp fed group in 1 day ... "	21	......	......	......	......	......	......	27	......	......
Beet and Molasses Meal fed group in 1 day ... "	......	......	21	......	......	......	......	......	......	18
Bran fed group in 1 day ... "	......	......	......	......	15	15	......	......	......	......
Alfalfa fed group in 1 day ... "	......	......	......	21	......	......	27	......	......	......
Extra meal fed group in 1 day ... "	......	21	......	......	......	......	......	......	18	......
Meal fed group in 4 weeks ... "	1,071	858	1,046	991	777	682	1,230	1,295	1,191	1,107
Ensilage fed group in 4 weeks ... "	14,068	11,025	10,325	10,285	6,780	6,615	11,277	11,592	8,316	7,812
Hay fed group in 4 weeks ... "	784	784	784	784	560	560	1,008	1,008	642	672
Roots fed group in 4 weeks ... "	1,568	1,568	1,568	1,568	1,120	1,120	2,016	2,016	1,344	1,344
Dried Beet Pulp fed group in 4 weeks ... "	588	......	......	......	......	......	......	756	......	......
Beet and Molasses Meal fed group in 4 weeks ... "	......	......	588	......	......	......	......	......	......	504
Bran fed group in 4 weeks ... "	......	......	......	......	420	420	......	......	......	......
Alfalfa fed group in 4 weeks ... "	......	......	......	588	......	......	756	......	......	......
Extra meal fed group in 4 weeks ... "	......	588	......	......	......	......	......	......	504	......
Value of food fed group in 4 weeks ... $	37.88	33.73	33.88	29.25	23.13	22.56	35.10	41.15	31.46	30.62
Value of food fed 1 cow in 1 day ... c.	19·3	17·1	17·2	14·9	16·5	16·1	13·9	16·3	18·7	18·2
Milk produced by group in 4 weeks ... Lbs.	2,356	2,040	2,722	2,550	1,818	1,795	2,952	2,838	3,567	3,103
Average daily yield of milk of 1 cow for 4 weeks .. "	12	6·8	13·8	13	12·9	12·8	11·7	11·2	21·2	18·4
Total yield of 1 cow in 4 weeks ... "	336·5	191·4	388·8	364·3	363·6	359	328	314	594·5	517·1
Yield of group during first week of period ... "	642	534	703	639	527	454	837	625	894	881
Yield of group during last week of period ... "	545	476	667	551	457	374	623	721	906	747
Change in yield of fourth week; decrease or increase "	− 97	− 58	− 36	− 88	− 70	− 80	−214	+ 96	+ 12	− 34
Normal percentage of decrease ... "	− 11	− 11	− 11	− 11	− 11	− 11	− 11	− 11	− 11	− 11
Actual percentage of decrease or increase ... "	− 15	− 11	− 5	− 14	− 13	− 17	− 25	+ 15	+ 1	− 4

BEEF PRODUCTION.

During the yea., somewhat less than usual has been done in the production of beef.

A number of lines of work were being concluded and no new work was undertaken. With one notable exception, the different lots fed showed a good profit and the year has, on the whole, been profitable for beef men.

The work reported upon includes three lots of steers raised upon the farm here and one lot of two-year-olds bought in Carleton county, Ont. The former were sold off at ages indicated in statements or else are still on hand. The purchased steers were fed for a short time only, and sent to the block in January, 1910.

SHORT KEEP.

Where steers can be put into the feed box in September, it is not infrequently the case that good profits can be made by selling in late December or early January rather than by carrying along till the spring. One advantage of feeding in such a way as to be ready to sell at the time mentioned is that the cattle are always about ready for the block should opportunity offer at any time after December 20 or thereabouts.

Lot 1.—Short Keep Steers, Two-year-old.

Number of steers in lot		7
First weight, gross, September 20, 1909	lbs.	7,455
First weight, average	"	1,065
Finished weight, gross	"	9,195
Finished weight, average	"	1,313·5
Total gain in 117 days	"	1,740
Average gain per steer	"	249
Daily gain per steer	"	2·12
Daily gain per lot, 7 steers	"	14·84
Gross cost of feed	$	121 46
Cost of 100 lbs. gain		6 33
Cost of steers, September 20, 1909		355 79
Total cost to produce beef		477 25
Sold 9,195 lbs. at $6 per 100 lbs., less 5 per cent		524 16
Profit		46 91
Profit per steer		6 70
Average cost per steer to start		50 82
Average selling price per steer		74 88
Average increase in value		24 06
Average cost of feed per steer		17 35
Amount of meal eaten by lot of 7 steers	lbs.	4,228·1
Amount of ensilage and roots	"	51,114
Amount of hay	"	3,043
Amount of straw eaten	lbs.	2,520

Meal consisted of bran, 1,500·8 lbs.; gluten meal, 2,306·3 lbs.; oil cake meal, 421 lbs. Clover hay, 2 parts; oat hay, 1 part; corn ensilage, 100 lbs.; turnips, 50 lbs. Straw cut and mixed with corn ensilage and pulped roots.

'CARRIED OVER' STEERS.

On March 31, 1909, these three steers formed part of a lot of 5 then 22 months old, sold for $4.75 per 100 lbs., live weight, less 5 per cent shrinkage. From the lot of five, these three were bought back at the same figure before leaving the stables, and carried on till January 15, 1910. These steers up to March 31, 1910, had not been profitable, for their record shows a small loss of $2.04 per steer up to that time.

The purpose in continuing the feeding of these steers was twofold. In the first place it was desired to see if they would redeem themselves if carried along till prices were better. In the second place, it was desired to see what could be done with dairy Shorthorn steers as were these.

The outcome, so far as profits were concerned, is rather disappointing, although just about what might have been expected. It is seldom indeed that steers in good shape as were these in March, 1909, can be carried over to the next winter with any assurance or even hope of profit on the outlay.

As to results of feeding, they were satisfactory. The three finished up into most excellent Christmas bullocks, and when slaughtered gave carcases equal to anything that the writer has seen on Canadian markets, thus demonstrating that dairy Shorthorns may leave good beef cattle. The fact of this lot not showing a profit is not due to their being from milking strains, but rather to their being carried too long.

Lot 2.—'Carried Over' Steers.

Number of steers in lot		3
First weight, gross, April 1, 1909	lbs.	2,660
First weight, average	"	887
Finished weight, gross, January 15, 1910	"	3,805
Finished weight, average	"	1,268
Total gain in 290 days	"	1,145
Average gain per steer	"	382
Daily gain per steer	"	1·32
Daily gain per lot, 3 steers	"	3·96
Gross cost of feed	$	133 73
Cost of 100 lbs. gain		11 68
Valuation put on steers, April 1, 1909		119 70
Total cost to produce beef		253 43
Sold 3,805 lbs. at $6.50 per 100 lbs. less 5 per cent		234 98
Loss		18 45
Loss per steer		6 15
Average valuation per steer to start		39 90
Average selling price per steer		78 33
Average increase in value		38 43
Average cost of feed per steer		44 58
Amount of meal eaten per lot of 3 steers	lbs.	4,712·6
Amount of ensilage and roots	"	43,869
Amount of hay	"	2,763
Amount of green feed	"	2,667
Amount of straw eaten	"	7,280

Meal consisted of bran, 1,232 lbs.; gluten meal, 2,838 lbs.; oil cake meal, 579·6 lbs., and corn meal, 63 lbs. Clover and peas and oat hay, corn ensilage, turnips, oat straw.

LONG FEED STEERS.

As containing some data of interest and value in connection with the 'long feeding' of steers housed from birth to block is submitted the following full history of the steers discussed as to their feeding during the last 290 days of their existence in lot 2.

History of Long Feed Lot. Dropped May 1, 1907; slaughtered, January 15, 1910, aged 2 years 8½ months.

Number of steers in lot		3	
First weight, gross, May 1, 1907	lbs.	252	
First weight average	"	84	
Finished weight, gross, January 15, 1910	"	3,805	
Finished weight, average	"	1,268	
Total gain in 990 days	"	3,583	
Average gain per steer	"	1,184	
Daily gain per steer	"		1·20
Daily gain per lot 3 steers	"		3·60
Gross cost of feed	$	252 37	
Cost of 100 lbs. gain		7 10	
Valuation put on steers, May 1, 1907		15 00	
Total cost to produce beef		267 37	
Sold 3,805 lbs. at $6.50 per 100 lbs, less 5 per cent		234 98	
Loss		32 39	
Loss per steer		10 80	
Average valuation per steer to start		5 00	
Average selling price per steer		78 33	
Average increase in value		73 33	
Average cost of feed per steer		83 12	
Amount of meal eaten per lot of 3 steers	lbs.	7,312	
Amount of ensilage and roots	"	79,932	
Amount of hay	"	6,567	
Amount of green feed	"	2,667	
Amount of straw eaten	"	7,899	
Amount of roots	"	2,226	

'BABY BEEF.'

The series of experiments along this line is being concluded. Results seem to point to the possibility of making beef production pay, on even the most expensive lands, if this method is followed, but always on condition that the greatest care be exercised in the selection of good individuals with which to work, the careful feeding from birth to block, and, most important of all, the getting of the steers ready for the block at a very early age. Earliest maturing steers have invariably shown good profits; lots carried along have not infrequently shown losses.

To insure a profit, steers should be ready for the best butcher's trade by or before 20 months old.

Lot 4.

BABY BEEF.

Feeding period, April 1, 1909, to January 15, 1910.—Dropped June, 1908.

Number of steers in lot		5
First weight, gross, April 1, 1909	lbs.	2,475

First weight, average	"	495
Finished weight, gross, January 15, 1910	"	5,245
Finished weight, average	"	1,049
Total gain in 290 days	"	2,770
Average gain per steer	"	554
Daily gain per steer	"	1·91
Daily gain per lot 5 steers	"	9·55
Gross cost of feed	$	169 40
Cost of 100 lbs. gain		6 12
Valuation put on steers, April 1, 1909		100 50
Total cost to produce beef		269 90
Sold 5,000 lbs. at $6.50 per 100 lbs		325 00
Profit		55 10
Profit per steer		11 02
Average valuation per steer to start		20 10
Average selling price per steer		65 00
Average increase in value		44 90
Average cost of feed per steer		33 88
Amount of meal eaten per lot of 5 steers	lbs.	6,808
Amount of ensilage and roots	"	51,150
Amount of hay	"	3,350
Amount of straw eaten	"	4,830

BABY BEEF.

Life history, June 15, 1908, to January 15, 1910—19 months.

Number of steers in lot		5
First weight, gross, June 15, 1908	lbs.	545
First weight, average	"	109
Finished weight, gross, January 15, 1910	"	5,245
Finished weight average	"	1,049
Total gain in 580 days	"	4,700
Average gain per steer	"	940
Daily gain per steer	"	1·62
Daily gain per lot 5 steers	"	8·10
Gross cost of feed	$	244 90
Cost of 100 lbs. gain		5 21
Valuation put on steers, June 15, 1908		25 00
Total cost to produce beef		269 90
Sold 5,000 lbs. at $6.50 per 100 lbs		325 00
Profit		55 10
Profit per steer		11 02
Average valuation per steer to start		5 00
Average selling price per steer		65 00
Average increase in value		60 00
Average cost of feed per steer		48 98
Amount of meal eaten per lot of 5 steers	lbs.	8,888
Amount of ensilage and roots	"	66,900
Amount of hay	"	5,165
Amount of straw eaten and bedded	"	11,000
Amount of skim milk	"	8,533
Amount of whole milk		750

Meal consumed consisted of bran, 2,632·1 lbs.; oil meal, 1,317·5 lbs; gluten meal, 3,065 lbs., and corn meal 121 lbs. Corn ensilage, 100 parts; turnips, 25 parts; mangels, 15 parts; clover hay, 2 parts; mixed hay, 1 part; oat straw.

Lot 6.

STEER CALVES.

Dropped June, 1909.

Number of steers in lot		9
First weight, gross, June 22, 1909	lbs.	1,065
First weight, average	"	118
Gross weight March 31, 1910	"	4,659
Finished weight, average	"	518
Total gain in 282 days	"	3,594
Average gain per steer	"	399
Daily gain per steer	"	1·41
Daily gain per lot 9 steers	"	12·69
Gross cost of feed	$	158 34
Cost of 100 lbs. gain		4 40
Valuation put on steers, June 22, 1909		45 00
Total cost to produce beef		203 34
Valued, 4,659 lbs. at $5 per 100 lbs		232 95
Profit		29 61
Profit per steer		3 29
Average valuation per steer to start		5 00
Average value price per steer at finish, March 31, 1910.		25 88
Average increase in value		20 88
Average cost of feed per steer		17 59
Amount of meal eaten by lot of 9 steers	lbs.	4,452·9
Amount of ensilage and roots	"	34,216
Amount of hay	"	4,820
Amount of straw eaten and bedded	"	6,317
Amount of skim milk	"	16,343

Meal consumed consisted of bran, 1,880 lbs.; gluten meal, 1,406·1 lbs.; oil meal, 1,067·5 lbs.; oats, 384·3 lbs. Mixed hay, 1 part; clover hay, 12 parts; oats and pea hay, 3 parts; oat straw, 2,341 lbs. fed; corn ensilage, 100 parts; turnips, 40 parts.

SHEEP.

Sheep have been kept on the Central Experimental Farm for the last ten years. No other breeds than Shropshire and Leicester have ever been bred. For several years so much trouble was experienced with stomach worm that it was feared sheep breeding would have to be abandoned. This was due to its being necessary to confine sheep almost entirely to a very limited area which, as was to be expected, resulted in infection. It is now hoped, however, that a way has been found to overcome this difficulty.

For the amount of labour involved and the cost of maintenance, the returns from the small flocks here have been quite as good as from any other line of live stock industry.

Very little experimental work of a character suitable for publication has been done as yet. The most important and interesting line of work was carried on during the last winter. The details of the work follow.

Considerable difficulty was experienced in securing, in this district, lambs fit to use in such work. Some wethers were found after some time, however, and fed as outlined below. The results from a financial point of view were very satisfactory, and should, in my opinion, suggest to sheep men the advisability of holding some of their lambs for winter feeding as such action would be an outlet for surplus forage and insure a much more remunerative price for the finished product.

As our Canadian cities grow, the demand for a superior article of lamb in the spring when supplies of fall-killed, cold-stored lambs are about exhausted (and very often of inferior quality), is certain to become much greater. Especially would this be true if a good article were available.

EXPERIMENT WITH FATTENING LAMBS.

In December, 1909, a lamb-feeding experiment was begun. The object of the experiment was to get some data as to the comparative value of turnips and corn ensilage as roughage for fattening lambs.

For this purpose, 28 lambs, about 7 months old, were selected and divided into three groups, as far as possible equal in weights and numbers. Twelve of these lambs were of Shropshire breeding and had been raised here. During the summer they had been somewhat troubled with worms and had not grown as they might have; a few of them were still low in flesh, though apparently healthy, at the time of going on experiment. Seven of these Shropshires were ram lambs and five were ewes. The sixteen others making up the groups were grade wethers of Leicester derivation bought in Carleton county, Ont. For three weeks previous to being delivered to the Experimental Farm they had been allowed to roam over the breeder's farm and feed on turnip tops and what other food they could find. They had been losing in flesh for some time before the experiment began. They had been purchased in November, but were not brought to the Farm until December 12.

On the 19th they were divided into three lots and put on experiment. The experiment lasted 90 days.

Lot 1.—Nine lambs, 3 rams and 6 wethers, weighed 900 lbs.

Lot 2.—Nine lambs, 4 rams and 5 wethers, weighed 901 lbs.

Lot 3.—Ten lambs, 5 ewes and 5 wethers, weighed 900 lbs.

The three lots were fed the same quantity of meal per head per diem throughout the experiment.

As roughage, lot 1 received as much turnips as they would clean up; lot 2 received as much ensilage as they would eat; lot 3 received as much turnips and ensilage as they would eat.

The roots and ensilage were fed in the proportions of about 7 of roots to 6 of ensilage. The hay was fed to each lot in varying quantities and just enough to give the ration sufficient dry material to keep the digestive organs about right. Details of feeding are given below.

After the experiment was started, so many ticks were found on the wethers that dipping was absolutely necessary. On December 26 the three lots of lambs were dipped. Their fleeces were so dense and heavy that five days were required to dry them in the cow barn. During that time they were all taken off the experiment and fed a ration of hay, corn ensilage and meal. This was rendered the more necessary on account of two sheep scouring, one in lot 1 and one in lot 2. On December 31 the experiment was resumed, and the different lots again fed as outlined above.

The hay they were fed was, from the beginning of the experiment to the last week of December, pea and oat hay of good quality. Next they were fed millet for one week, and then good alfalfa hay till March 5, 1910. From then to the end of the experiment, March 18, 1910, June-grass hay was fed.

The meal mixture was constant in composition: 200 lbs. nutted oil cake, 200 lbs. bran and 100 lbs. whole oats.

Of this mixture, each lamb received 8 ozs. per diem during the first week, 12 ozs. the second week, 14 ozs. the third week, 16 ozs. the fourth week, 17 ozs. the three succeeding weeks and 18 ozs. the remainder of the period.

The ensilage was made from a well-eared corn, cut in the early glazing stage.

The roots were turnips well kept.

The hours of feeding were regular. The morning feed was given between 8 and 8.30; the noon feed between 12 and 12.30, and the night feed between 4.15 and 4.45 p.m. Except in very few cases the same man was attendant.

The first weighing was made at 10 a.m. the day the lambs were put on experiment. Subsequent weighings were made every two weeks at the same hour till the last day of the experiment.

The health of the different lots was good at start, and remained so throughout the experiment, except in two cases where a couple of lambs scoured somewhat, one in lot 1 and another in lot 2. This condition was met with every time the hay ration got below one pound per sheep per diem, and necessitated the decreasing of the roots and ensilage until scouring lambs recovered.

One aim of the experiment throughout was to feed as large quantities of the roots and ensilage as possible; this accounts for one or two lambs going off feed. In some instances they did not actually scour, but their condition interfered with the regular feeding of the lots, thus materially lowering the daily rate of grain.

The safe minimum quantity of hay to feed daily per lamb would appear to be about one pound. The amount of other feeds fed should be gaged so that each lamb will be likely to take at least this amount of hay, otherwise the rate of gain may be lowered.

In calculating the cost of feeding, the following prices were charged:—

Roots (turnips)	$ 2 00	a ton.
Ensilage (corn)	2 00	"
Hay (mixed)	7 00	"
Bran	20 00	"
Nutted oil cake	35 00	"
Whole oats	25 00	"

TABLE 1.—LAMB FEEDING EXPERIMENT.

(Weights, Gains and Percentage Dressed.)

Ear Tag No.	First weight.	Last weight.	Gains.	Weight of Carcass.	Percentage Dressed.	Daily Gain per Sheep.
Lot 1	lbs.	lbs.	lbs.	lbs.	%	lbs.
No. 63	95	130	35	54	41·5	·38
54	100	133	33	60	45·1	·36
64	94	128	34	58	45·3	·37
953	88	103	15	45	42·8	·16
954	112	118	6	60	50·8	·06
952	105	121	16	61	50·4	·17
962	112	126	14	55	43·6	·15
963	106	126	20	64	50·8	·22
965	88	112	24	56	50·0	·26
Total	900	1097·0	197·0	513	——	——
Average	100	121·9	21·9	57	46·7	·24
Lot 2						
No. 51	128	164	36	74	45·1	·40
57	77	107	30	52	39·2	·33
60	87	108	21	46	42·2	·23
58	105	136	31	64	47·0	·34
960	93	110	17	55	50·0	·18
955	108	130	22	67	51·5	·24
957	99	116	17	53	45 7	·18
964	100	109	9	54	49·5	·10
958	104	118	14	61	51·7	·15
Total	901	1098·0	197·0	526.0	——	——
Average	100	122	21·9	58.4	46·9	·24
Lot 3						
No. 53	65	94	29	43	45·7	·21
65	62	82	20	43	52·4	·22
62	84	99	15	40	48·7	·16
59	85	110	25	not		·27
56	60	82	22	killed		·24
959	101	122	21	66	54·1	·23
950	114	128	14	65	50·7	·15
951	115	122	7	67	54·1	· 7
961	98	117	19	53	45·3	·21
956	116	133	17	70	52·6	·18
Total	900	1089·0	189·0	447·0	——	——
Average	90	109·9	18·9	55·8	50·4	.21

TABLE 2.—LAMB FEEDING EXPERIMENT.

(Summary.—28 lambs.)

First weight, three lots, 28 lambs	lbs.	2,701
Average first weight	"	96·4
Rate of gain per day, average	"	0·23
Final weight of whole lot	"	3,284

Final weight, average..	"	117·3
Cost of feeding 28 lambs 90 days..	$	58 75
Total gain in period..	lbs.	583
Cost of 1 lb. gain for whole lot..	cts.	10·7

Amount of various kinds of feed consumed for one pound gain live weight during 90 days:—

Bran..	lbs.	1·82
Oats..	"	·91
Oil cake..	"	1·82
Hay..	"	6·16
Turnips..	"	9·67
Ensilage..	"	8·05
Amount dry matter consumed for one pound gain during period..	"	12·2

TABLE 3.—LAMB FEEDING EXPERIMENT.

(Table of Weights and Gains.)

Date of Weighing.	Lot 1.		Lot 2.		Lot 3.	
	Total weights by lots.	Gain per lamb per day.	Total weights.	Gain per lamb per day.	Total weights.	Gain per lamb per day.
Dec. 19, '09	900	....	901	....	900	
Dec. 29, '09	920	·22	896	·06*	919	·19
Jan. 12, '10	981	·48	957	·48	999	·57
Jan. 26, '10	989	·06	970	·10	991	·06*
Feb. 9, '10..........................	1,019	·24	996	·21	1,016	·18
Feb. 23, '10..........	1,045	·21	1,031	·28	1,029	·09
Mar. 9, '10..........................	1,068	·18	1,072	·32	1,070	·29
Mar. 19, '10..............	1,097	·32	1,098	·28	1,089	·19
Average daily gain.............		·244		·244		·21

*Loss.

TABLE 4.—LAMB FEEDING EXPERIMENT.

General Statement.—Turnips vs. Corn Silage as Succulent Feed for Fattening Lambs.

—	Lot 1.	Lot 2.	Lot 3.
Number of lambs in lot	9	9	10
Number of days in experiment	90	90	90
Total weight at beginning of experiment	900	901	900
Total weight at end of experiment	1,097	1,098	1,089
Gain for period	197	197	189
Gain per head	21·88	21·88	18·9
Gain per head per day	·244	·244	·21
Quantity of meal eaten by lot for period	852	852	955
Quantity of mixed hay eaten by lot for period	1,385	1,116	1,091
Quantity of roots (turnips) eaten by lot for period	3,461	....	2,180
Quantity of ensilage (corn) eaten by lot for period	145	2,753	1,818
Total cost of feed	$19.93	18.14	20.68
Cost of feed per head $	2·21	2.01	2.06
Cost per head per day	·023	·021	·022
Cost to produce 1 lb. gain	·10	·09	·109
Original cost of sheep at 5 cts. a pound live weight	45.00	45.05	45.00
Original cost of sheep plus cost of feed	64.93	64.19	65.58
Sold at 7·25 cts. a pound live weight	79.53	79.60	78.95
Net profit on lot	14.60	16.41	13.37
Net profit per lamb	1.62	1.82	1.30

TABLE 5.—LAMB FEEDING EXPERIMENT.

Some Scientific Findings in Connection therewith.

—	Lot 1.	Lot 2.	Lot 3.
Pounds dry matter required to produce one pound increase in live weight	12·20	11·95	13·14
Nutritive ratio of ration	1 : 4·6	1 : 4.6	1 : 4·4
Meal required to produce one pound increase in live weight	4·32	4·32	5·50
Roughage required to produce one pound increase in live weight	25·3	19·6	26.9
Hay required to produce one pound increase in live weight	7·03	5·6	5·7
Roots required to produce one pound increase in live weight	17·5	....	11.5
Ensilage required to produce one pound increase in live weight	....	14·0	9.6
Pounds digestible matter consumed to produce one pound increase in live weight	7·4	7·0	8·0

SWINE.

A large number of swine have been bred and handled during the year 1909-10. Prices for feed have been very high, but prices for pork have been unusually good and financial results have been very satisfactory, as the following summary of operations indicates.

SUMMARY OF PIGGERY OPERATIONS, 1909-10.

	$ cts.	$ cts.
Total sales during year	3,137 25	
Value of manure produced in year	200 00	
Value of pigs on hand April 1, 1910	2,425 00	
		5,762 25
Cost of feed during year	1,521 56	
Cost of labour	850 00	
Value of pigs on hand April 1, 1909	2,617 00	
		4,988 56
Profit for year		773 69

In addition to the actual sales, a considerable amount of experimental feeding, that it was expected would not prove very profitable, was carried on. The cost of feeds for such experiments is included above as well as the cost of extra labour involved in conducting such experiments. There were handled during the year about 450 pigs. Of course quite a large number of these were sold at two months old for breeding purposes. Prices for such range from $6 to $10 each.

SOWS.

The practice of wintering sows in the open with only single board cabins to protect them from the winter cold and snow has been continued. This has been done in the case of both aged and young (under one year) sows.

During the past winter, an experiment including some 34 sows of different ages and breeds was conducted to gain some data as to the comparative cost of wintering sows in various ways as outlined in the table below.

The sows fed inside in 1909-10 had given excellent results when wintered outside last year, 1908-9.

Lot 1.—These two sows were in 1908-9 among our best mothers, but, when fed as indicated and under adverse conditions as to quarters, the results were quite disastrous.

Lot 2.—These two sows were in 1908-9 very satisfactory producers and again gave us some good litters, but the pigs were not so vigorous and healthy as could have been desired.

Lot 3.—These sows had given good litters the previous year when fed similarly. They did well again, as the table shows.

Lot 4.—In wintering young sows, the growth of the sow must be considered as well as and even as more important than the young she carries. It has on this account been found necessary to feed young sows wintered outside more liberally than aged sows. Thus the young sows, although much smaller than the aged sows, cost half a cent a day more for food than did the aged. The table indicates the difference in the rations fed the two classes during the winter.

SOW FEEDING EXPERIMENT.

Lot.	No. and description of sows in pen.	Housing.	Date of commencing.	Date of finishing.	No. of days in experiment.	Amount of meal consumed.	Amount of roots consumed.	Amount of milk consumed.	Total cost of ration.	Cost of sow per day.	Ration.	Remarks.
									$ cts.	Cts.		
1	2 Aged.	Confined in pen 10 × 8.	Dec. 16, 1909.	April 6, 1910.	111	2,094	....	444	28 80	12·5	Barley, corn and shorts, equal parts by weight. 2 lbs. skim milk per sow per day.	Both sows got very fat and pigs came large, fat and weak, many having no hair. All dead but four within the first two days.
2	2 Aged.	Confined in pen 10 × 8.	Dec. 16, 1909.	April 6, 1910.	111	1,332	1,332	888	18 64	8·35	200 lbs. shorts, 100 lbs. oats, 200 lbs. bran-roots equal parts by weight with meal. 4 lbs. skim milk per sow per day.	Both sows gave large litters of uniform and fairly strong pigs.
3	20 Aged.	Wintered in open. Slept in cabins 6 × 8.	Dec. 13, 1909.	April 2, 1910.	111	5,860	22,600	Hay, 1,800	100 45	4·5	Clover hay fed long. Roots cooked and fed warm. Bran and shorts fed mixed with roots or dry.	Sows give large litters of excellent pigs. Mortality of young pigs very low.
4	10 Young.	Wintered in open. Slept in cabins 6 × 8.	Dec. 28, 1909.	April 6, 1910.	100	3,390	5,010	Milk. 2,250	50 22	5·0	Mixture of bran, oats and shorts, fed warm with cooked roots. Skim milk. Some raw roots with dry meal.	Sows giving good large litters of healthy pigs.

In all cases, the rations fed sows vary from month to month following a fairly regular gradation. To begin with, in early winter coarse rough feed is given in abundance. As the gestation period advances this is changed to a somewhat more nutritious ration until, at a few weeks before farrowing time, the sows are being very liberally fed on highly nutritious but easily digested food. In early feeding more particularly, the aim is to keep the digestive organs comfortably distended by suitable food which shall not at the same time be such as to cause undue fattening.

FATTENING RATIONS.

In September, 1909, a bunch of forty young sows was divided into eight groups of five each. They were, the first week, fed on a uniform ration as follows:—

Shorts	lbs.	500
Ground oats	"	100
Nestor or feed flour	"	100
Bran	"	100

Roots equal parts by weight with meal.

Skim milk, 2 lbs. per diem per pig.

This meal mixture with roots and skim milk in the proportions named has given such uniformly good results when fed here that it has been taken as a standard of excellence and other feeds are considered good or bad according as they equal or fall short of this ration in rate and economy of gains induced. In comparison with two lots fed on this ration, four lots were fed on a mixture of corn and barley, equal parts, and a half pound tankage per pig per diem. Tankage was supplied by Swift & Co., packers, Chicago, U.S.A.

Two other lots were fed on corn and barley, equal parts, without any other food.

Meal mixture was in all cases fed raw in a moderately thick slop. The subjoined tables show all details.

Feeds were valued as follows:—

Roots	$ 2 00	per ton
Corn	30 00	"
Barley	25 00	"
Oats	25 00	"
Nestor or feed flour	30 00	"
Shorts	25 00	"
Bran	20 00	"
Skim milk	4 00	"

TABLE 1.—PIG EXPERIMENT.

Pen 7. Starting period, Sept. 30, Oct. 5, 1909.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 56 days.	Gain per pen in 56 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	$	c.	
Y 976........	111	123	12								500 lbs. shorts.
T............	92	102	10								100 " oats, gr.
Y 981	127	146	19	68	13·6	2·7	103	103	1.41	2·0	100 " nestor.
B 909........	100	111	11								100 " bran.
Y 971........	93	109	16								Roots equal parts by weight with meal.
Total	523	591	68								2 lbs. skim milk per pig per day.

Pen 8.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 56 days.	Gain per pen in 56 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
T 924	99	119	20								
T 922	65	74	9								
Y 979......	100	111	11	60	12·0	2·4	103	103	1.41	2·3	
Y 980........	98	109	11								
Y 978........	85	94	9								
Total	447	507	60								

Pen 3.

TABLE 2.—PIG EXPERIMENT.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 56 days.	Gain per pen in 56 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
922	168	182	14								500 lbs. shorts.
930........	158	167	9								100 " oats.
931........	150	161	11	63	12·6	2·5	134	134	1.84	2·8	100 " nestor.
T............	120	134	14								100 " bran.
928	110	125	15								Roots equal parts by weight with meal.
Total	706	769	63								2 lbs. skim milk per pig per day.

Pen 2.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 56 days.	Gain per pen in 56 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
907 A...	60	70	10								
903 A........	70	80	10	42	8·4	1·6	74	74	1.03	2·4	
908 A........	65	70	5								
902 A........	70	80	10								
920...........	83	90	7								
Total	348	390	42								

TABLE 3.—PIG EXPERIMENT.

Pen 4. Starting period Sept. 30, Oct. 5, 1909.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 56 days.	Gain per pen in in 56 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	$	c.	
Y 917	171	180	9								500 lbs. shorts.
T 903	141	147	6								100 " oats.
Y 937	145	158	13	53	10·6	2·1	134	134	181	3·4	100 " nestor.
Y 935	140	154	14								100 " bran.
T 913	105	116	11								Roots equal parts by weight with meal.
Total	702	755	53								2 lbs. skim milk per pig per day.

Pen 1.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 56 days.	Gain per pen in in 56 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
B 912	100	103	3								
Y 996	98	103	5								
B 913	97	100	3	18	3·6	·7	74½	74½	1·04	5·7	
Y 900A	84	85	1								
Y 994	66	72	6								
Total	445	463	18								

TABLE 4.—PIG EXPERIMENT.

Pe ı 5.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 56 days.	Gain per pen in in 56 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
918	102	108	6								500 lbs. shorts.
957	150	160	10								100 " gr. oats.
956	140	155	15	49	9·8	103	103	1·41	2·09	...	100 " nestor.
941	120	128	8								100 " bran.
927	100	110	10								Roots equal parts by weight with meal.
Total	612	661	49								2 lbs. skim milk per pig per day.

Pen 6.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 56 days.	Gain per pen in in 56 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
Y 950	143	158	15								
T 920	95	107	12								
T 919	95	105	10	57	11·4	2·7	103	103	1·41	2·4	
Y 952	138	151	13								
Y 940	135	142	7								
Total	606	663	57								

TABLE 5.—PIG EXPERIMENT.

Pen 5. Main period, Oct. 5, Nov. 30, 1909.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 56 days.	Gain per pen in 56 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	$	c.	
918	108	173	65	....	....	....	....	....	....	....	Corn and barley equal parts.
957	160	217	57	....	..	....	....	....	....	....	
956	155	209	54	272	54·4	·97	1,432	....	19 69	7·2	
941	128	187	59	....	..	....	....	....	....	....	
927	110	147	37	....	....	....	....	....	....	....	
Total	661	933	272	....	....	....	....	....	....	....	

Pen 6.

950	158	206	48	....	..	....	....	....	....	....	
920	107	155	48	....	....	....	....	....	....	....	
919	105	151	46	275	55·0	·98	1,396	....	19.19	6·9	
952	151	210	59	....	....	....	....	....	....	....	
940	142	216	74	....	....	....	....	....	....	....	
Total	663	938	275	....	....	....	....	....	....	....	

TABLE 6.—PIG EXPERIMENT.

Pen 4.

917	180	259	79	....	....	..	....	....	....	....	500 lbs. shorts.
903	147	215	68	....	....	....	....	....	....	..	100 " gr. oats.
937	158	227	69	361	72·2	1·28	1,402	1,402	19.76	5·4	100 " nestor.
935	154	235	81	....	....	....	....	....	....	....	100 " bran.
913	116	180	64	....	....	..	....	....	....	....	Roots equal parts by weight with meal.
Total	755	1,116	361	....	....	....	....	....	....	....	2 lbs. skim milk per pig per day.

Pen 1.

912	103	160	57	....	....	...	....	....	....	....	
996	103	172	69	....	....	....	....	....	....	...	
913	100	157	57	291	58·2	1 03	963	963	13.83	4.8	
900 A	85	140	55	....	....	..	....	....	....	....	
994	72	125	53	....	....	....	....	....	....	....	
Total	463	754	291	....	....	....	....	....	....	....	

TABLE 7.—PIG EXPERIMENT.

Pen 3. Main period, Oct. 5, Nov. 30, 1909.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 56 days.	Gain per pen in 56 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	$	c.	
922	182	263	81								
930	167	228	61								
931	161	240	79	351	70·2	1·25	1,644		22 60	6·4	Corn and barley equal parts with ½ lb. per pig per day tankage.
	134	188	54								
928	125	201	76								
Total	769	1,120	351								

Pen 2.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 56 days.	Gain per pen in 56 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
907 A	70	140	70								
903 A	80	161	81								
908 A	70	148	78	375	75·0	1·33	1,172		16·11	4·2	
902 A	80	154	74								
920	90	162	72								
Total	390	765	375								

TABLE 8.—PIG EXPERIMENT.

Pen 7.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 56 days.	Gain per pen in 56 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
976	123	192	69								
	102	137	35								
981	146	245	99	334	66·8	1·19	1,325		18·21	5·4	Corn and barley equal parts with ½ lb. per pig per day tankage.
909	111	185	74								
971	109	166	57								
Total	591	925	334								

Pen 8.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 56 days.	Gain per pen in 56 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
924	119	148	29								
922	74	117	43								
979	111	207	96	313	62·6	1·11	1,169		16·07	5·1	
980	109	184	75								
978	94	164	70								
Total	507	820	313								

TABLE 9.—PIG EXPERIMENT.

Pen 5. Finishing period Nov. 30, Dec. 7, '09.

Ear Tag Number.	Weight, Oct. [illegible] 1909.	Weight, Nov. 30, 1909.	Gain per pig in 7 days.	Gain per pen in 7 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	$	Cts.	
918	173	190	17								
957	217	236	19								
956	209	233	24	98	19·6	2·8	132	132	1.88	1·9	Standard.
941	187	207	20								
917	147	165	18								
Total	933	1,031	98								

Pen 6.

Ear Tag Number.	Weight, Oct. [illegible] 1909.	Weight, Nov. 30, 1909.	Gain per pig in 7 days.	Gain per pen in 7 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
950	206	227	21								
920	155	170	15	79	15·8	2·2	132	132	1.88	2·3	
919	151	171	20								
952	210	217	7								
940	216	232	16								
Total	938	1,017	79								

TABLE 10.—PIG EXPERIMENT.

Pen 4.

Ear Tag Number.	Weight, Oct. [illegible] 1909.	Weight, Nov. 30, 1909.	Gain per pig in 7 days.	Gain per pen in 7 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
917	259	279	20								
903	215	217	2								
937	227	235	8	49	9·8	1·4	135	135	1.92	3·9	Standard.
935	235	245	10								
913	180	189	9								
Total	1,116	1,165	49								

Pen 1.

Ear Tag Number.	Weight, Oct. [illegible] 1909.	Weight, Nov. 30, 1909.	Gain per pig in 7 days.	Gain per pen in 7 days.	Average gain per pig.	Average gain per pig per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain L. W.	Ration.
912	160	172	12								
996	172	185	13								
913	157	173	16	71	14·2	2·0	122	122	1.75	2·4	
900 A	140	156	16								
994	125	139	14								
Total	754	825	71								

PIG EXPERIMENT TABLE 11.

Pen 3. Finishing Period Nov. 30, Dec. 7, 1909.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 7 days.	Gain per pen in 7 days.	Average gain per pig.	Average gain per pig, per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain, live weight.	Ration.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	$	c.	
922	263	281	18								
930	228	253	25								
931	2·0	255	15								Standard.
	188	207	19	97	19.4	2.7	134	134	1.91	1 9	
928	201	221	20								
Total	1,120	1,217	97								

Pen 2.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 7 days.	Gain per pen in 7 days.	Average gain per pig.	Average gain per pig, per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain, live weight.
907 A	140	161	21							
903 A.	161	184	23							
908 A	148	166	18	90	18 0	2·5	121	12		1·9
902 A	154	169	15							
920	162	175	13							
Total	765	855	90							

PIG EXPERIMENT TABLE 12.

Pen 9.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 7 days.	Gain per pen in 7 days.	Average gain per pig.	Average gain per pig, per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain, live weight.	Standard.
976	192	222	30								500 lbs. shorts.
	137	152	15								100 " ground oats.
981	245	258	13	93	18·6	2·6	123	123	1·76	1 8	100 " Nestor.
909	185	200	15								100 " bran.
971	166	186	20								Roots equal parts by weight with meal.
Total	925	1,018	93								2 lbs skim milk per pig per day.

Pen 8.

Ear Tag Number.	Weight, Oct. 5, 1909.	Weight, Nov. 30, 1909.	Gain per pig in 7 days.	Gain per pen in 7 days.	Average gain per pig.	Average gain per pig, per day.	Amount of meal consumed.	Amount of roots consumed.	Total cost of ration.	Cost of one pound gain, live weight.
924	148	170	22							
922	117	135	18							
979	207	227	20	100	20	2·8	123	123	1 76	1·7
980	184	206	22							
978	164	182	18							
Total	820	920	100							

PIGGERY VENTILATION.

In wintering sows as outlined earlier in this report, the question of ventilation is a matter of great simplicity. When it becomes, however, a question of wintering pigs in warmer pens, as must be done in the case of young fall pigs if any profits are to be hoped for, the problem of securing an ample supply of fresh air, without lowering the temperature unduly, is exceedingly hard to solve. To gain some information on this subject, two single-pen piggeries were constructed in the autumn of 1898, special provision being made to try various systems of ventilation in each of them.

The buildings were constructed of wood with cement floors. They were in each case 16½ feet long, 15 feet wide and 8 feet ceiling, with double half-pitch roof and loft over head.

The walls were made of 4-inch studding, two papers outside and one paper inside, single board and batten outside and V-jointed inside. The joists were ceiled. There were four windows in each pen; they were hinged at the bottom and chained to hang about two feet open at the top when so desired. Double windows were used in winter.

The ceiling of pen 1 had a slightly inverted hopper shape with an outlet pipe from the centre or highest part of the ceiling. The ceiling of pen 2 was slightly higher at the back than at the front; besides this peculiarity, the ceiling or boarding under the joists stopped completely about 4 feet from the rear wall, leaving the joists exposed. Above the joists, rising from a point where the ceiling stopped, and reaching to the plate (about 2 feet above the joists) 3 or 4 short beams carry stout slats 2 inches thick nailed in place about 2 inches apart and running horizontally at right angles to the joists. These slats were covered with about 2 feet deep of loose oat straw.

During the continuance of the experiments, two bunches of feeding pigs were housed in these pens. They were usually equal in number and about equal in weight, so that the quantity of air required and the impurities to be carried off were about equal at all times in the two pens.

EXPERIMENT NO. 1.

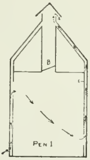
Since it would be exceedingly difficult to convey a clear idea of the direction of air currents and relative locations of inlets and outlets by the use of words alone, cross sections or diagrams are used.

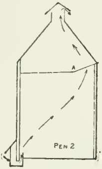
In pen 1, the King system of ventilation is in operation, the shaft 'B' being closed. At the point 'C' is an opening into the outlet flue, but it was kept closed during this experiment.

In pen 2, the escaping air works its way slowly up through the straw resting on the slats as previously described at 'A' and thence out through the open cupola on the roof.

VENTILATION TABLE 1.

Period 1. From Feb. 16, 1910 to Feb. 22, 1910, inclusive.	Outside.		Pen 1.			Pen 2.		
	Temperature.		Temperature.			Temperature.		
	Av. Max.	Av. Min.	Av. 7.30 a.m.	Av. Max.	Av. Min.	Av. 7.30 a.m.	Av. Max.	Av. Min.
	°	°	°	°	°	°	°	°
Degrees Fahr.........	23·2	12.5	32·0	42·2	25·7	31·8	42 4	26·1
Variation from outside . .	....	....	....	19·0	13·2	....	19 2	13·6
No. of pigs in pen..........	....	....		10			10	
Remarks............	....	.	Ceiling and walls damp			Ceiling and walls quite dry.		



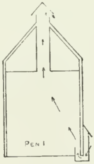


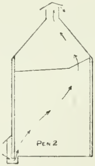
EXPERIMENT NO. 2.

In this experiment the King system was closed up and the Rutherford put into operation in pen 1. The effect was noticeable in the much drier atmosphere, walls and ceiling. In pen 2 the same system as in experiment 1 was continued.

VENTILATION TABLE 2.

Period 2. From Feb. 23, 1910, to March 8, 1910, inclusive.	Outside. Temperature.		Pen 1. Temperature.			Pen 2. Temperature.		
	Av. Max.	Av. Min.	Av. 7.30 a.m.	Av. Max.	Av. Min.	Av. 7.30 a.m.	Av. Max.	Av. Min.
	°	°	°	°	°	°	°	°
Degrees Fahr	23·6	10·1	30·5	42·2	26·4	29·5	40·6	26·0
Variation from outside				18·6	16·3		17·0	15·9
No. of pigs in pen			10			10		
Remarks			Ceiling and walls dry. Pigs quite comfortable.			Ceiling and walls dry. Pigs comfortable.		





EXPERIMENT NO. 3.

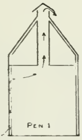
In this experiment trial was made of overhead currents entirely.

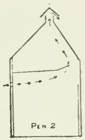
In pen 1.—The King inlet was combined with the Rutherford outlet.

In pen 2.—An opening through the wall near the ceiling let in a direct and unobstructed current of air. The outlet was kept as in experiments 1 and 2. The results were fairly satisfactory, the pen being kept somewhat colder than was liked.

VENTILATION TABLE 3.

Period 3. From Mar. 9, '10, to Mar. 15, '10, inclusive.	Outside.		Pen 1.			Pen 2.		
	Temperature.		Temperature.			Temperature.		
	Av. Max.	Av. Min.	Av. 7.30 a.m.	Av. Max.	Av. Min.	Av. 7.30 a.m.	Av. Max.	Av. Min.
	°	°	°	°	°	°	°	°
Degrees Fahr..................	30 2	15·5	32 2	43·8	29·7	29·8	41·2	28·2
Variation from outside ...	.... ..	....	....	13·6	14·2	....	11·0	12·7
No. pigs in pen....	....	......		10			10	
Remarks.............. ..	.. . ...	...	Walls and ceilng dry.			Walls and ceiling dry.		





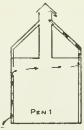
EXPERIMENT NO. 4.

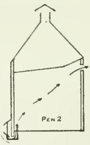
In this experiment the King system of ventilation was put into operation in pen 1. the upper outlet being opened instead of the lower.

In pen 2, the foul air was allowed a free outlet through direct opening in the wall. This was fairly satisfactory.

VENTILATION TABLE 4.

Period 4. From Mar. 16, '10, to Mar. 29, '10, inclusive.	Outside. Temperature.		Pen 1. Temperature.			Pen 2. Temperature.		
	Av. Max.	Av. Min.	Av. 7:30 a.m.	Av. Max.	Av. Min.	Av. 7:30 a.m.	Av. Max.	Av. Min.
Degrees Fahr...............	° 32·1	° 20·4	° 36·6	° 47·8	° 31·0	° 33·0	° 43·7	° 32·5
Variation from outside	....	....	.. ..	15·7	11·3	....	11·6	12·1
No. pigs in pen.....	....		....	7			7	
Remarks.	....		Walls and ceiling fairly dry.			Walls and ceiling fairly dry.		





CONCLUSIONS.

Not quite enough work has as yet been done to permit of absolute conclusions being drawn. In addition to the above experiments, however, various lots of young feeding pigs, sows with pigs and weaning pigs were kept in these pens during the winter, 1909-10, just passed. The two systems shown in operation in experiment 2, as described above, were continuously retained in action. The results were uniformly satisfactory and would seem to point to either one or other of these two systems as being suitable for piggery ventilation in this latitude.

FINANCIAL STATEMENT.

Below are submitted inventories and returns from the various classes of live stock under my charge during the year April 1, 1909, to March 31, 1910.

Class.	April 1, 1909.		April 1, 1910.		Returns.	Gross returns made up of increase in value of products and value of animals sold.
	Number.	Value.	Number.	Value.	Value.	
		$ cts.		$ cts.	$ cts.	$ cts.
Horses	19	....	19	....	3,923 08	3,923 08
Breeding cattle	123	14,615 00	121	16,705 00	5,999 34	8,089 34
Steers	20	950 00	22	740 00	2,747 47	2,537 47
Sheep	31	690 00	51	775 00	38 22	123 22
Swine	130	2,617 00	65	2,425 00	3,137 25	2,945 25
Total	328	17,140 00	281	20,645 00	15,845 36	17,618 36

SUMMARY OF LIVE STOCK OPERATIONS.

Returns.

Gross returns from animals of all classes, including value of products, value of services and increases in value of young stock. $17,618 36
Manure, 1,500 tons at $1 per ton. 1,500 00

Total. $19,118 36

Expenditure—Value of food consumed.

Meal, grain, &c. (market price). . . . . $ 5,715 30
Hay at $7 per ton. 1,205 60
Roots, ensilage, green feed at $2 per ton. 1,925 00
Whole milk, 18,700 lbs. at $1 per 100 lbs. 187 00
Skim milk, 65,000 lbs. at 20c. per 100 lbs. 130 00
Straw, 155 tons at $5 per ton. 775 00

Total. . . . . $ 9,937 90

Cost of labour in connection with care of horses, cattle, sheep and swine:—

Herdsman	$ 720 00	
One man	600 00	
Three men at $528	1,584 00	
Two men at $500	1,000 00	
Extra help, teaming, &c.	350 00	
		$ 4,254 00
Total expenditure		14,191 00
Balance		$ 4,926 00
Less cost of steers and new stock purchased 1909-10		635 00
Net balance		$ 4,291 00

SUMMARY OF FARMING AND LIVE STOCK OPERATIONS ON 200-ACRE FARM, 1909.

Returns.

Total value of returns from fields	$ 5,502 15	
Total value of returns from live stock	19,118 36	
Total returns		$24,620 51

Expenditure.

Total cost of field operations	$ 2,778 71	
Total cost of live stock operations	14,191 00	
Expended, buying stock	635 00	
Total expenditure		$17,604 71
Balance		$70,015 80

COMPARATIVE Statement of Crops on '200 Acre Farm,' from 1899 to 1909 inclusive. (200 Acre Farm includes 7 Acres of Roads.)

Year.	Grain.		Hay.		Roots and Corn.		Pasture.		Soiling Crop.		Pig Pasture.		Remarks.
	Area in Acres.	Yield in Pounds.	Area in Acres.	Yield in Tons.	Area in Acres.	Yield in Tons.	Area in Acres.	Number of Cattle.	Area in Acres.	Disposition of Crops.	Area in Acres.	Crops Grown for Pasture.	
1899	73	118,466	39	93	40	326½	40	36	1	Fed to dairy cows	..	....	Generally considered a good year for all crops.
1900	80	126,621	53	138	40	743	20 and aftermath.	49	....	....	.	......	Season very favourable for most crops.
1901	79	114,472	58	210	40	702	16 and aftermath.	52	....	....	....	....	" " "
1902	74	144,914	60	216	39	665	20 and aftermath.	62	....	....	5	Clover, rape and aftermath.	Season favourable for hay, bad for corn.
1903	69	126,619	62	154	34	473	16 and aftermath.	96	5	Dairy cows, bulls and calves.	6	Clover and rape.	Season very unfavourable for most crops, particularly adverse to corn and roots. No second crop hay.
1904	67	112,009	60	192	46⅔	674	13 75	98	3	" "	3	" " ..	Season unfavourable for grain and corn, good for hay and roots.
1905	66	111,932	59	258	47	971½	14 and aftermath.	100	5	All cattle ensilage fed.	4	Clover, rape, mixed crop, peas, roots and alfalfa.	Season favourable for hay, corn and roots, too wet for grain on mucky land.
1906	69	125,516	62	140	48	774½	14	105	5	" " ..	3	" " .	Very bad season. Meadows winter killed. Summer too dry.
1907	61	102,494	73	227	46	704	13·75	110	5	" " ..	3	" " ..	Bad hay year. Grain fair. Corn and roots poor.
1908	61	63,003	62	175	49	670	14	120	5	" " ..	3	" " ..	Very bad year for all classes of crops. Too dry.
1909	65	106,572	57	142	49	878	14	142	5				Bad hay year. Grain fair. Corn and roots good.

Of the area indicated as having been used as pasture for swine in 1905, 3 acres yielded a crop of green feed for soiling cattle before being given over to swine. Cattle were pastured on roads where possible. A small rough field not included in '200 Acre Farm' is used as partial pasture and a run for about 20 head of young stock. These cattle receive ensilage or other succulent food every day, and meal at the rate of about 1½ lbs. each per day part of the time.

The variety of crops grown and the varying areas under each crop each year, make it quite difficult to make a comparison of the returns of the different years, so to simplify matters I would suggest that a fixed valuation be put upon the products and the return of each year valued accordingly.

Fixing prices as follows:—Grain, $1 per 100 lbs.; roots and ensilage, $2 per ton; hay, $7 per ton; summering cattle, $8 per season, and an area used as pasture for pigs, $15 per acre. The returns from the '200-acre farm' for the years mentioned may be said to have been worth $2,776.66 in 1899, $4,110.21 in 1900, $4,434.72 in 1901, $4,787.14 in 1902, $4,148.19 in 1903, $4,741.09 in 1904, $5,714.32 in 1905, $4,669.16 in 1906, $4,931.94 in 1907, $4,631.33 in 1908 and $5,502.15 in 1909.

Prices for all kinds of forage in 1908 and 1909 were so very high that had market prices been allowed for the crops of 1908 and 1909 the total values would have been much higher.

REMARKS ON ROTATION EXPERIMENTS.

The true farmer will ever have two objects in view when managing his farm: to so manage as to gradually but surely increase the margin of profit and, at the same time, render his farm more productive. Many factors will necessarily unite to produce such desirable results, but of one feature we may be certain, there will be followed on such a farmer's farm a regular rotation of crops, for no other single practice in farm management can compare with this in importance. The rotation or rotations adopted will, of course, depend upon the line of farming followed, and to some extent upon the character of the soil and the physical peculiarities of the farm as a unit, but a rotation there will be.

Crop rotation means a certain rotation of crops which regularly repeats itself each time the course is run. It really means further that the crops follow each other in such order as to insure each having such supplies of plant food of such a character as to aid in securing good returns from each particular crop.

Hence, in arranging a rotation, it is very necessary to have some knowledge of the food requirements of different crops and to know something of the values of the residues from the different crops included. Certain forage crops, such as corn, roots, potatoes and hay require an immense amount of food for stem, leaf and root production—that is an abundance of nitrates as is found in clover or other sod turned down and in well-manured lands. Other crops, such as cereals, can get along best with a lighter supply of nitrates, but need more phosphates, hence do well after some forage crop has taken up the superabundance of free nitrates found after sod. It is evident, therefore, that a good rotation will include (1) meadow or pasture, (2) roots or corn, and (3) some cereal crop.

Various combinations of these three classes are possible, and the natural aim of experimental work will be to determine (1) the comparative values of rotations as soil improvers, and (2) their relative suitability for different lines of farming.

Five or six years' experience with a rotation of five years' duration showed such remarkable results here, that, in 1904, it was decided to begin an experiment that would include a variety of rotations.

FERTILIZER ROTATIONS.

In addition to the regular rotations that have been under experiment since 1904, it has been found possible to introduce in 1909 three rotations having for object the gaining of some information as to the value of commercial fertilizers in regular farm rotation. Ever since the inception of soil cultivation work at the Central Experimental Farm, more or less experimental work has been carried on in the use of

commercial fertilizers. Up to the year 1909, however, no regular work had been undertaken to test the value of such fertilizers as substitutes to a greater or less extent for barnyard manure in regular farm crop rotations.

In 1909, it was found possible to take 12 acres of land whereon to conduct some experiments using superphosphate, muriate of potash and nitrate of soda as substitutes to a greater or lesser extent for the barnyard manure usually applied.

The land chosen includes light loam, heavy clay loam, clay hard pan and a considerable area of black muck. The land is all well drained and in fair heart, but rather badly infested with weeds. This condition is due to the land having been used for some years in rotation where no hoed crops were included.

The various rotations are, exclusive of fertilizer rotations:—

Rotation 'A.'

First year.—Land ploughed in August, well worked, ribbed in October; seeded next spring to oats, and 10 lbs. clover sown per acre; allowed to grow one year and turned under as fertilizer for corn.

Second year.—Corn, manure applied in winter or spring, 25 tons per acre; shallow ploughed, corn planted.

Third year.—Grain, seeded down, 8 lbs. red clover, 2 lbs. alsike, 10 to 12 lbs. timothy per acre.

Fourth year.—Clover hay, two crops expected.

Fifth year.—Timothy hay.

Rotation 'B.'

First year.—Grain, land ploughed previous autumn. Seeded down 10 lbs. red clover, 2 lbs. alsike, 5 lbs. timothy per acre.

Second year.—Clover hay, two crops expected.

Third year.—Corn, manured in winter, 20 to 25 tons per acre; spring ploughed.

Fourth year.—Grain, seeded down, red clover 10 lbs. alsike 2 pounds and 5 lbs. timothy per acre. Land fall-ploughed after corn; very shallow furrow.

Fifth year.—Clover hay, two crops; late fall ploughed.

Rotation 'E.'

First year.—Manured and handled as 'Z.'

Second year.—Oats, seeded down, 10 lbs. red clover, 6 lbs. alfalfa, 2 lbs. alsike, 6 lbs. timothy per acre.

Third year.—Pasture. Cattle.

Rotation 'Z.'

First year.—Manure, 12 to 15 tons per acre, applied winter; shallow ploughed in spring; well worked and planted to corn.

Second year.—Oats, seeded down, 10 lbs. red clover, 2 lbs. alsike, 6 lbs. alfalfa and 6 lbs. timothy per acre.

Third year.—Clover hay; two crops expected.

Rotation 'S.'

Shallow ploughing; deep cultivation by means of stiff tooth cultivator or subsoiler.

First year.—Roots or corn, plough August, 4 inches deep; manure 15 to 20 tons per acre; work at intervals, ridge up in fall, sow to roots in spring.

Second year.—Grain, seeded down, 10 lbs. red clover, 12 lbs. timothy per acre
Third year.—Clover hay.
Fourth year.—Timothy hay.

Rotation 'D.'

Deep ploughing; plough August, 7 inches deep; manure 15 to 20 tons per acre; work with cultivator at intervals. Land ploughed late autumn, 7 inches; roots or corn next spring.

Second, third and fourth year.—Same as 'S.'

Rotation 'H.'

First year.—Manured in fall and manure ploughed in, well worked; sown to roots next spring.

Second year.—Different grain mixtures suitable for feeding green. Different grass seed mixtures suitable for pasture and soiling next year.

Third year.—Pasture. Swine.

Rotation 'T.'

Sheep pasture.

Crops just as in 'S' save that various mixtures of grain and grass seed are used to test their value for sheep feeding and pasturing.

OTHER ROTATIONS.

Four other rotations were tried for some time. They included no hoed crop, however, and had to be discontinued as it was found impracticable to keep the land free from weeds.

RETURNS PER ACRE.

To compare results under such varied crop and cultural conditions is a rather difficult matter. The plan adopted has been to place an arbitrary and uniform valuation on all products and on pasturing various classes of stock. Following this plan, the returns per acre have been about as follows, the average of five years' work:—

Rotation 'A.'

Average value of crop per acre per annum. $22 63

Rotation 'B.'

Average value of crop per acre per annum. 23 15

Rotation 'E.'

Average value of crop per acre per annum. 20 81

Rotation 'Z.'

Average value of crop per acre per annum. 24 74

Rotation 'S.'

Average value of crop per acre per annum.. .. .. 26 05

Rotation 'D.'

Average value of crop per acre per annum.. .. .. 25 85

Rotation 'H.'

Average value of crop per acre per annum.. .. .. 29 10

Rotation 'T.'

Average value of crop per acre per annum.. .. .. 19 30

PROFITS PER ACRE.

The values placed on products were: Roots or silage stored, \$2 per ton; hay, \$7 per ton; grain, \$1 per 100 lbs.; oat straw, \$4 per ton; pasturing cows, \$1 per month. Sheep and swine pastured, one cent per day.

In estimating cost of operation, labour is charged at prices paid, machinery is put at 30 cents per acre, rent at \$3 per acre and manure at \$3 per acre.

Net profits, after paying all expenses, were as follows per acre, the average for five years:—

'A' net profit per acre	.. ..	\$ 8 55
'B' " "	.. ..	8 55
'E' " "	.. ..	6 91
'Z' " "	.. ..	8 39
'S' " "	.. ..	7 22
'D' " "	.. ..	7 07
'H' " "	.. ..	7 61
'T' " "	.. ..	3 31

VALUE OF DIFFERENT ROTATIONS.

The averages used are for five years. A study of the various rotations would lead one to remark upon them briefly as follows:—

Rotation 'A.'—This rotation has been in use here for 11 years and has proven to be most excellent where carefully followed and cultural operations well performed. Where all land was under cultivation, it would be found necessary to devote a certain area to soiling crops. It might be extended to six years by leaving down to pasture for two years instead of one.

Rotation 'B.'—This rotation has been fairly successful here, but, for certain reasons not easily enumerated, I do not feel as though I could either criticise or praise as yet and feel sure of my ground.

Rotation 'E.'—This rotation would not be suitable for the average farmer, but might suit the man who had to buy rough forage.

Rotation 'Z.'—This would be a most excellent rotation to put into practice where sufficient rough land was available to serve as pasture. It is the rotation that would

most likely supply the greatest amount of forage of the best description for dairying or beef production. It is better suited for heavy than for light soils.

Rotation 'S.'—This is a rotation that has been in use for a number of years on the Agricultural College Farm at Guelph, where it has given satisfactory results. It is possibly open to the criticism of having too small a proportion of land under grain. Where live stock is, however, the mainstay, this is a very minor fault. The turning of a shallow furrow when ploughing sod has been found to be good practice here when preparing for grain or corn. In preparing for roots the regular plough with subsoiler is to be advised.

Rotation D.'—This rotation is the same as rotation 'S' so far as crops are concerned. The results so far obtained show the advantage in favour of either shallow ploughing and deep cultivation or deep ploughing.

Rotation 'H.'—The area devoted to pigs (some 10 acres) where this rotation is followed has given very satisfactory returns, and would, I feel confident, prove profitable to any one who followed it carefully.

Rotation 'T.'—Sheep. The returns from this rotation are not strictly comparable with those from others, since many side experiments materially affect the results. It has, however, proven very satisfactory for this class of stock.

As already stated, the rotation experiments have been under way for five years now. Three out of the five years have been what might be called 'lean years' in the Ottawa valley, hence these rotations can hardly be said to have yet shown what they are capable of doing in the way of influencing crop production.

The few facts given above are, however, strictly comparable each with the others, excepting possibly 'T' or sheep, where some rather disturbing conditions have been introduced.

THE ROTATIONS IN 1909.

The experiment to determine the values of the different rotations as discussed above is being followed up, and below the detailed report of the labour on each plot and the return therefrom, will be found some brief notes on each field and on the rotation as a whole.

The rotations are as follows:—

Rotation 'A.'—Five years. Clover hay, timothy hay, grain, corn, grain.

Rotation 'B.'—Five years. Clover hay, grain, clover hay, corn, grain.

Rotation 'E.'—Three years. Pasture, corn, grain.

Rotation 'Z.'—Three years. Clover hay, corn, grain.

Rotation 'S.'—Four years. Shallow ploughing, clover hay, timothy hay, roots, grain.

Rotation 'D.'—Four years. Deep ploughing, clover hay, timothy hay, roots, grain.

Rotation 'H.'—Three years. Hog pasture, roots, grain or soiling crops.

Rototion 'T.'—Four years. Sheep pasture, roots and soiling crops, grain, clover hay.

In the description of the rotations and fields that follow, an effort is made to give as concisely as possible the location of each field, its size, the character of its soil, its drainage and its general crop history.

In the tables will be found all items of expenditure. The manure is applied in the same ratio to each field in each rotation. To illustrate: If to the corn land in rotation 'Z' 15 tons of manure per acre is applied, this is equivalent to 5 tons per acre per anumn, as 'Z' is a three-year rotation. Then, in applying manure to 'B' 25 tons would be applied, as 'B' is a five-year rotation. Since manure must vary in quantity each year, $3 per acre per annum is charged in each rotation.

COMPARATIVE VALUES OF ROTATIONS ON STOCK FARMS.

Supposing the average animal of the bovine species to consume 2,000 lbs. hay, 6 tons ensilage and roots, 1 ton straw, 4 months pasture and 1,000 lbs. meal in a year, this would amount to about $37 or $38 as the cost of feeding an animal for a year. Keeping these figures in mind, the stockman can form some idea of the comparative values of the different rotations for live stock farming.

ROTATION

Lot.	Location.	Description of Soil.							Area in acres.	Crops.		Items of	
		Sand.	Sandy loam.	Clayey loam.	Clay.	Black muck.	Gravel.	Hardpan.				Rent and Manure.	Seed, Twine and use of Machinery.
		p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	Ac.	1908.	1909.	$ cts.	$ cts.
A 1	W. S. 3	30	45	...	..	25	....	....	9·96	Hay	Hay	59 76	12 94
A 2	L.S. 1	39	65	5	...	...	....	....	8·90	Grain	Hay	53 40	11 57
A 3	A.S. 14	10	15	20	20	15		20	10·20	Hay	Grain	61 20	17 11
A 4	W.P G.S. 1 / F S. 1	70	20	10	....	....	....	...	8 89	Grain	Grain	53 34	13 90
A 5	F.S. 3	....	35	30	10	15	10	..	8·56	Hay	Corn	51 36	14 62
	Aggregate								46·51			279 06	70 14
	Average per acre in 1909								1·00			6 00	1 50
	Average for five years								....			6 00	1 57

ROTATION

Lot.	Location.	Sand.	Sandy loam.	Clayey loam.	Clay.	Black muck.	Gravel.	Hardpan.	Area in acres.	1908.	1909.	Rent and Manure.	Seed, Twine and use of Machinery.
B 1	W.S. 4	5	35	5	50	5	....	...	10·00	Grain	Corn	60 00	17 00
B 2	L.S. 2	20	70	....	5	5	....	..	8·83	Corn	Hay	52 92	11 46
B 3	A.S. 15	20	60	5	....	15	. .	..	10·20	Grain	Grain	61 20	17 00
B 4	W.P.G.S. 2	20	60	15	....	5	...	....	9 15	Hay	Grain	54 90	15 36
B 5	F.S. 2	....	30	30	40	....	....	....	8·93	Hay	Hay	53 58	11 60
	Aggregate								47·11			282 60	72 42
	Average per acre in 1909								1·00			6 00	1 53
	Average for five years								....			6 00	1 52

Rotation 'A.'

This rotation of five years' duration includes grain, hay (two years), grain and corn or roots, in the order named. The grain crop mentioned first comes after corn. With the first crop of grain is sown 10 lbs. red clover, 1 lb. alsike and 10 lbs. timothy per acre. The field is left in hay for two years; then in August of the second year it is ploughed and cultivated at intervals till October, when it is ridged up and left till next spring. Oats are sown on this field, and with them red clover seed at the rate of 10 lbs. per acre. This clover is allowed to grow for something over a year, or until corn seeding time the following spring, when it is turned under with a shallow furrow along with the manure that will have been applied during the winter. After the corn has been harvested, the land is ploughed shallow and left till the next spring.

The crops on this rotation have not been very satisfactory this year. On 'A 1' a crop of hay was grown. 'A 2' was in hay also, but on account of dry weather only one crop was harvested off each hay field. On 'A 3' the crop grown was oats and gave a very fair crop. 'A 4' gave a light crop of grain on account of lack of moisture as a large part of this field is sandy soil. On 'A 5' a crop of corn was grown and gave a fair return.

SESSIONAL PAPER No. 16

'A'

Expenses in Raising Crop in 1909.								Particulars of Crop in 1909.						
Manual labour.		Horse labour.												
Hours.	Cost of Manual labour.	Hours, single horse.	Hours with team.	Value, horse labour.	Threshing.	Total cost.	Cost for one Acre.	Grain.	Straw.	Hay.	Roots and Ensilage.	Total value.	Value of Crop per Acre.	Profit per Acre in 1909.
No.	$ cts.	No.	No.	$ cts.	$ cts.	$ cts.	$ cts.	Lbs.	Lbs.	Lbs.	Lbs.	$ cts.	$ cts.	$ cts.
53	8 83	3½	33	10 77	...	93 30	9 37	......	.....	32,000	.....	112 00	11 24	1 87
41½	7 41	5	38¾	12 87	.....	85 26	9 56	.....	.....	48,300	....	169 05	18 09	8 53
56	9 33	4	172½	59 23	12 41	159 23	15 61	16,882	27,328	.....	....	223 45	21 90	6 29
35	5 83	..	183½	35 16	8 21	116 44	13 00	11,174	15,676	....	......	143 09	16 09	3 09
242	38 66	12	197	68 79	......	173 43	20 26	...	......	....	245,000	245 00	28 62	8 36
430½	70 06	24½	544¾	186 82	20 62	627 71	....	28,056	43,004	80,300	245,000	892 59	.....	.....
9·2	1 50	·5	11·7	4 01	44	.....	13 50	603	924	1,705	5,267	....	19 18	5 68
15·3	2 37	4·8	9·92	4 34	29	......	14 65	596	739	1,854	6,084	....	22 63	8 55

'B'

416	67 26	9	240	77 55	....	221 81	22 18	...	......	....	352,240	352 24	35 22	13 04
60½	10 08	3	37½	12 00	....	86 46	9 79	....	..	54,790	....	191 80	21 72	11 93
53	8 83	4	93	33 40	10 82	131 34	12 87	14,721	24,624	....	....	195 73	19 18	6 31
31	5 16	3½	102	36 62	8 27	120 35	13 15	11,268	18,942	....	....	150 56	16 45	3 30
94	15 66	4½	107	37 06	......	117 90	13 35	......	.....	41,655	30,740	176 53	19 76	6 41
651½	106 99	24	579½	196 72	19 09	677 86	....	25,989	43,566	96,445	382,980	1,006 86	....	.....
13·8	2 27	·5	12·3	4 17	40	.....	14 38	551	924	2,047	8,129	....	22 64	8 19
13·1	2 65	5·3	9·5	4 41	31	....	14 98	571	990	2,436	6,233	....	23 15	8 55

Rotation 'B.'

This rotation of five years' duration includes grain, hay, grain, hay and corn or roots in the order named, the first crop of grain following a crop of corn or roots. Red clover, 10 lbs.; alsike, 1 lb., and timothy, 5 lbs., is sown with the grain each time grain is sown. When grain follows hay, the land is ploughed in the early fall. When corn follows hay the land is ploughed in the spring, the spring growth of grass and clover being ploughed in along with the manure which will have been applied during the preceding winter.

The crops on this rotation were fairly satisfactory.

'B 1' was in corn and gave a good crop.

On 'B 2' a crop of hay was grown, but on account of dry weather the crop was not as good as expected.

'B 3' was under grain and gave a very fair crop. Banner oats.

'B 4.' The crop grown was oats; part of this field is light soil, and the summer being dry the crop was small.

From 'B 5' a good crop of mixed hay was harvested.

ROTATION

Lot.	Location.	Description of Soil. Sand.	Sandy loam.	Clayey loam.	Clay.	Black muck.	Gravel.	Hardpan.	Area in acres.	Crops. 1908.	1909.	Rent and manure.	Seed, twine and machinery.
		p. c.	p. c,	p. c.	p. c.	p. c.	p. c.	p. c.	Ac.	1908.	1909.	$ cts.	$ cts.
H 1........	H S. 1......	30	40	20	10	....	...	..	3·35	Roots..	Grain ..	20.10	5.05
H 2...... ..	H S. 2......	25	45	20	10	....	....	....	3 15	Oat hay....	Pasture.. ..	18 90	4.09
H 3.......	H S. 3......	10	20	50	20	..	..	....	2 85	Pasture.....	Roots	17.10	3.70
		Aggregate.....							9·35	... .	... .	5i.10	12.84
		Average per acre in 1909.. ..							1·00	.. ..	. . ..	6.0	1.37
		Average for five years...........								... ..	. . ...	6 00	1.07

ROTATION

Lot.	Location.	Sand.	Sandy loam.	Clayey loam.	Clay.	Black muck.	Gravel.	Hardpan.	Area in acres.	1908.	1909.	Rent and manure.	Seed, twine and machinery.
T 1	S.S. 1 ...	10	90	....	....	....	....	...	1·51	Roots	Hay.. . .	9.06	1.96
T 2	S S. 2.. ...	15	85	....	....	....	....	....	2 78	Hay.. .. .	Roots . ..	16·68	3 61
T 3...	S S. 3	....	100	.. .	...	.. .	...	...	3 27	Hay and Pasture...	Pasture.. .	19 62	4 25
T 4........	S.S. 4.. ...	15	85	....	....	....	....	...	3 50	Hay.. ..	"	21.00	4 55
		Aggregate							11 06	.. ..	....	66.36	14 37
		Average per acre in 1909....							1 00	. ...	....	6.00	1.29
		Average for five years......								....	.. ..	6.00	1 41

Rotation 'H.'

(Hog Farm.)

This rotation is of three years' duration, and includes roots, soiling crop and pasture in the order named. The land is ploughed late in the fall after it has been manured. It is disced the next spring and the roots sown on ridges. The roots receive the usual cultivation and are of varied character, including mangels, sugar mangels, sugar beets and turnips, devoted to pork production for the most part, the surplus being sold to cattle and the returns invested in meal for pig feeding.

The soiling crop field is sown with various crops suitable for feeding to pigs. What is over and above the amount possible of consumption by pigs is charged to the cattle at $2 per ton and the returns used to purchase meal for pork production.

The pasture area is divided into several parts, the seed being sown, as far as possible, at the same time as the soiling crops the previous year, and not allowed to be eaten too close the first fall, although any good growth is not wasted.

'H 1.'—This field was under grain and gave an excellent crop of oats.

'H 2.'—This plot was used for pasture.

'H 3' was under roots (turnips), and an excellent crop was harvested.

" H ".

Items of expense in raising crop in 1909.								Particulars of crop in 1909.						
Manual Labour.		Horse Labour.												
No. of hours.	Cost of manual labour.	Hours, single horse.	Hours with team.	Value horse labour.	Threshing.	Total cost.	Cost for one acre.	Grain.	Straw.	Hay.	Roots and ensilage.	Total value.	Value of crop per acre.	Profit per acre in 1909.
Hrs.	$ cts.	Hrs.	Hrs.	$ cts.	$ cts.	$ cts.	$ cts.	Lbs.	Lbs.	Lbs.	Lbs.	$ cts.	$ cts.	$ cts.
28	4.66	.. .	41	12.75	4.60	47.16	14.07	6,258	15,002	....	....	92.58	27.63	13.56
. . .	. . .	....	....	......	......	22.99	7.29	......	.. .	....	. . . .	31.50	10.00	2.71
207	31.05	25	46	20.71	.... .	72.56	25.46	.....	......	....	160,356	160 35	56.26	30 80
235	35.71	25	87	33.46	4.60	142 71	46 82	6,258	15,002	....	160,356	284.43	.... .	....
358	3 80	2 6	9·5	3.57	0.49	......	15.26	669	1,604	....	17,161	..... .	30 42	15.16
42	4.51	5·4	9·0	4.22	0.16	....	17.07	201	453	168	18,441	......	29.10	7.61

'T ".

9	1.50	1	32½	10.00	... ..	22.52	14.91	.....	... .	6,800	....	23.80	15.76	0.85
129	19.35	20	76½	27.95	...	67.59	24.31	......	....	....	72,036	72.03	25.90	1.59
....	..	....	....	.....	......	23.87	7.30	......	....	...	....	32 70	10.00	2.70
...	.....	....	....	.....	......	25.55	7.30	.....	......	....	....	35 00	10.00	2.70
138	20.85	21	109	37.95	...	139.53	53.82	......	......	6,800	72,036	163.53	...	. .....
12·4	1.88	1·8	9·8	3.41	. .. .	......	12.61	......	.....	614	6,513	. ....	14 78	2.17
28·0	4 12	5·2	9·0	4.02	......	....	15.40	....	339	1,582	8,543	....	19.30	3.31

Rotation 'T.'

(Sheep Farm.)

This rotation of four years' duration includes roots, grain, hay and pasture.

The area devoted to sheep farming is rather limited, about 11·06 acres. This area is not included in the '200-acre' farm. The whole area has been for several years devoted to pasturing sheep, but it has been divided into four rather unequal fields, susceptible of further subdivision, and devoted to a rotation considered suitable for sheep.

The root field is devoted to white turnips, swedes, cabbage, kohl rabi, thousand-headed kale, &c. It comes after the pasture, the land being manured and ploughed in the fall.

Grain follows on the root land, and with the grain various clovers and grass seeds are sown to prepare for the ensuing two years. The grain may be harvested or used for soiling crop for sheep. The hay field is expected to give one crop of hay and then be devoted to pasture for lambs as soon as they are weaned.

The pasture field is the field that has been in hay the previous year. Alfalfa, red clover, alsike clover, brome grass (bromus inermis) and timothy are the clovers and grasses used.

The crops on this rotation were fair this year.

ROTATION

Lot.	Location.	Description of Soil.							Area in acres.	Crops.		Items of	
		Sand.	Sandy loam.	Clayey loam.	Clay.	Black muck.	Gravel.	Hardpan.				Rent and manure.	Seed, twine and use of machinery.
		p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	Ac.	1908.	1909.	$ cts.	cts.
D 1...	E.G.P.S. 2..	20	80	....	....	....	....	....	2	Grain ..	Hay	12 00	2 60
D 2..	E.G.P.S. 4..	20	80	....	....	....	....	....	2	Hay..	"	12 00	2 60
D 3...	E.G.P.S. 6..	30	70	....	....	....	....	....	2	"	Roots	12 00	2 60
D 4...	E.G.P.S. 8.	60	40	....	....	....	....	....	1·56	Roots	Grain ...	9 3[illegible]	2 44
	Aggregate								7·56	....	....	45 [illegible]	10 24
	Average per acre in 1909								1	....	....	6 00	1 35
	Average for five years........								....	....	....	6 00	1 22

ROTATION

Lot.	Location.	Sand.	Sandy loam.	Clayey loam.	Clay.	Black muck.	Gravel.	Hardpan.	Area in acres.	1908.	1909.	Rent and manure.	Seed, twine and use of machinery.
S 1....	E.G.P.S. 1..	20	80	....	....	....	....	....	2	Grain	Hay	12 00	2 60
S 2....	E.G.P.S. 3..	20	80	....	....	....	....	....	2	Hay	"	12 00	2 60
S 3....	E.G.P.S. 5..	30	70	....	....	....	....	....	2	"	Roots	12 00	2 60
S 4....	E.G.P.S. 7..	60	40	....	....	....	....	....	2	Roots ..	Grain ...	12 00	3 15
	Aggregate								8	....	....	48 00	10 95
	Average per acre in 1909.								1	....	....	6 00	1 37
	Average for five years.								......	....	....	6 00	1 24

Rotation 'D.'

(Deep Ploughing.)

This rotation is of four years' duration and includes grain, two-years' hay and corn or roots.

The grain crop follows hoed crop, the land being ploughed to a depth of about seven inches, or cultivated after the hoed crops are harvested in the fall. With the grain is sown 10 lbs. red clover and 12 lbs. timothy seed per acre. The clover hay is cut twice in the season, and the second aftermath left on the field; that is, it is not pastured off as is usually done. In the second hay year two crops are cut if possible, and the land ploughed in August with a deep seven-inch furrow.

'D 1' and 'D 2.'—These plots were under hay this year; they gave fairly good crops.

'S 3' was under roots and gave an excellent crop.

On 'D 4' a light crop of grain was grown.

"D."

Expense in raising Crop of 1909.								Particulars of Crop in 1909.						
Manual Labour.		Horse Labour.												
No. of hours.	Cost of manual labour.	Hours with single horse.	Hours with team.	Value of horse labour.	Threshing.	Total cost.	Cost for one acre.	Grain.	Straw.	Hay.	Roots and ensilage.	Total value.	Value of crop per acre.	Profit per acre in 1909.
Hrs.	$ cts.	Hrs	Hrs	$ cts.	$ cts.	$ cts.	$ cts.	Lbs.	Lbs.	Lbs.	Lbs.	$ cts.	$ cts.	$ cts.
13	2 16	1	7½	2 50	.....	19 26	9 63	.....	......	9,025	9,610	41 18	20 59	10 96
12½	2 08	1	7	2 35	......	19 03	9 51	.	...	8,270	.....	28 91	14 47	4 96
210	31 50	6	80½	24 27	......	70 37	35 18	..	....	......	100,190	100 19	50 09	14 91
6	1 00	....	18	6 06	1 41	20 27	12 99	1,922	2,768	....	....	24 75	15 86	2 87
241½	36 74	8	113	35 18	1 41	128 93	..	1,922	2,768	17,295	109,800	195 03	..	....
31·9	4 85	1	15	4 65	0 18	.....	17 05	254	366	2,287	14,524	......	25 80	8 75
36·5	6 34	5·5	11·5	5 14	0 18	....	18 97	632	552	2,977	10,937	....	25 85	7 07
"S."														
13	2 16	1	7½	2 50	...	19 26	9 63	...	......	8,140	9,720	37 76	18 88	9 25
12½	2 08	1	7	2 35	....	19 03	9 51	...	....	8,920	.	31 22	15 61	6 10
206	30 90	6	72	23 76	...	69 26	34 63	...	......	....	104,400	104 40	52 20	17 57
7	1 16	....	22½	7 50	1 85	25 66	12 83	2,529	3,211	....	....	31 71	15 85	3 02
238½	36 30	8	109	36 11	1 85	133 21	. .	2,529	3,211	17,060	114,120	205 09	...	
29 3	4 53	1	136	4 51	0 23	.....	16 65	316	401	2,132	14,265	....	25 64	8 99
42·4	6 29	6·6	112	5 48	0 20	....	18 83	603	562	2,977	10,841	....	26 03	7 22

Rotation 'S.'

(Shallow Ploughing.)

This rotation is of four years' duration and includes grain, two-years' hay, roots or corn.

The grain crop follows hoed crop, the land being ploughed (or cultivated) to a depth of about four inches after the hoed crops are harvested in the fall. With the grain is sown 10 lbs. red clover and 12 lbs. timothy seed per acre. The clover hay is cut twice in the season and the second aftermath left on the field; that is, it is not pastured off as is usually done. In the second hay year two crops are cut if possible, and the land ploughed in August with a shallow four-inch furrow. If manure is applied before ploughing, a subsoiler is attached to the plough to loosen up the soil to a depth of 8 or 9 inches. If manure is not applied, this end is attained by means of a strong, deep-reaching cultivator after the sod has rotted in the fall or the next spring.

'S 1' and 'S 2.'—These plots were under hay this year; they gave fairly good crops.

'S 3' was under roots and gave an excellent crop.

'S 4' was under grain and gave a light crop.

ROTATION

Lot.	Location.	Description of Soil. Sand.	Sandy loam.	Clayey loam.	Clay.	Black muck.	Gravel.	Hardpan.	Area in acres.	Crops. 1908.	1909.	Rent and manure.	Seed, twine and use of machinery.
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	Ac.			$ cts.	$ cts.
E 1......	W. S. 1.....	40	40	..	....	15	5	....	14·00	Grain	Pasture....	84 00	18 20
E 2...	L. S. 4.. .	10	60	....	10	20	. .	..	13·75	Corn.. ...	Grain	82 50	23 81
E 3...	Morn.	30	60	5	....	....	....	..	13·80	Hay	Corn.. ...	82 80	23 99
	Aggregate...								41·55	....	....	249 30	66 00
	Average per acre in 1909......								1	...	....	6 00	1 58
	Average for five years............								....	......	....	6 00	1 80

ROTATION

Lot.	Location.	Sand.	Sandy loam.	Clayey loam.	Clay.	Black muck.	Gravel.	Hardpan.	Area in acres.	1908.	1909.	Rent and manure.	Seed, twine and use of machinery.
Z 1..	W. S. 2.....	40	40	....	....	15	5	....	6·00	Grain	Hay.......	36 00	7 80
Z 2.. . .	L. S. 3.....	10	60	10	....	20	....	....	5·81	Corn.... ...	Grain	34 86	9 42
Z 3.... ...	Obs. S	10	60	20	10	..	....	...	3·50	Pasture.....	Corn.......	21 00	6 03
	Aggregate ...								15·31	....	. ...	91 86	23 25
	Average per acre in 1909..								1	....	....	6 00	1 51
	Average for five years..								. . .	. . ...	....	6 00	1 76

Rotation 'E.'

This rotation of three years' duration includes grain, pasture and corn.

The grain comes after the corn, the stubble of which is treated as described under rotation 'A.' With the grain in the spring is sown 10 lbs. red clover, 2 lbs. alsike, 6 lbs. alfalfa and 6 lbs. timothy seed per acre. If weather permits, the field is pastured slightly in the fall.

After the grain crop the land is pastured, the grass seeding having been done with this object in view. In estimating the value of the returns from this field pasture is charged at $1 per month per cow. At this rate the returns fall very far short of what would have been the returns if a hay crop had been harvested, if we may judge by the returns from 'Z.' This rotation and rotation 'Z' were introduced into the list in order to gain some idea as to the difference in returns probable from land pastured and land from which all the crops are harvested. It was expected that the corn crop after the pasture would in a measure make up for the difference in favour of the no-pasture rotation 'Z,' but the returns are on the whole a good deal short of those from 'Z.'

Corn follows the pasture. Manure is applied during the fall and winter and turned under with the growth of clover and grass in the spring.

Crops were all good on this rotation in 1909.

'E.'

Items of Expense in Raising Crop in 1909.								Particulars of Crop in 1909.						
Manual labour.		Horse labour.												
Hours.	Cost of manual labour.	Hours, single horse.	Hours with team.	Value, horse labour.	Threshing.	Total cost.	Cost for one acre.	Grain.	Straw.	Hay.	Roots and ensilage.	Total value.	Value of crop per acre.	Profit per acre in 1909.
No.	$ cts.	No.	No.	$ cts.	$ cts.	$ cts.	$ cts.	Lbs.	Lbs.	Lbs.	Lbs.	$ cts.	$ cts.	$ cts.
..	.....	....	....	.....	......	102 20	7 30	......	.....	....	... .	140 00	10 00	2 70
66	11 00	5½	150½	51 38	18 93	187 62	13 64	25,750	36,350	....	. . ..	330 20	24 01	10 37
365	59 33	18	278½	94 08	....	260 20	18 85	......	....	....	456,645	456 64	33 08	14 23
431	70 33	23½	429	145 46	18 93	550 02	.....	25,750	36,350	....	456,645	926 84	....	......
10·3	1·69	·5	10·3	3 49	1 45	.....	12 53	619	874	....	10,990	....	22 30	9 77
16 0	1·84	2·8	9·5	6 15	38	. .	14 65	555	802	....	8,729	....	20 81	6 91

'Z'.

44	7 33	5½	24	8 57	.....	59 70	9 95	....	....	35,020	....	122 57	29 42	10 47
24	4 00	2½	44½	16 46	7 57	72 32	12 44	10,302	15,398	....	.. ...	133 80	23 02	10 58
118	19 00	7	81	28 33	.....	74 36	21 24	....	....	....	122,420	122 42	34 97	13 73
186	30 33	15	149½	53 36	7 57	206 38	43 63	10,302	15,398	35,020	122,420	378 79	.	......
12 1	1·98	·8	9·7	3 48	49	.....	13 48	672	1,005	2,287	8,000	....	24 74	11 26
16·3	2·77	6·0	8·2	3 72	24	. . . .	12 57	522	813	2,087	9,321	....	23 68	8 39

Rotation 'Z.'

This rotation of three years' duration includes corn, grain and clover hay in the order named.

Corn comes after the clover hay. The manure is applied during the fall or during the winter and spring, and the clover allowed to grow up through it, so facilitating the turning under the whole mass of manure, late fall growth and spring growth of clover a few days before the corn is to be sown. The furrow turned is quite shallow, about five inches deep, and the land is then disc-harrowed and the corn sown in rows 42 inches apart. It receives later the usual cultivation and care.

Grain follows corn, the land having been ploughed in the fall. With the grain there is sown 10 lbs. red clover, 2 lbs. alsike, 6 lbs. alfalfa and 6 lbs. timothy seed per acre. The hay is cut twice aud the last aftermath allowed to grow up to be turned under the next spring for corn. Such a rotation would be particularly valuable to a farmer having sufficient rough land for pasture, or to one desirous of keeping as many cattle as possible on the land at his disposal, supposing him willing to grow roots and corn.

Crops on this rotation were all good in 1909.

FERTILIZER

Lot.	Location.	Description of Soil.							Area in acres.	Crops.		Items	
		Sand.	Sandy loam.	Clayey loam.	Clay.	Black muck.	Gravel.	Hardpan.				Rent and Manure.	Seed, twine and use of machinery.
		p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	Ac.	1908.	1909.	$ cts.	$ cts.
A 1	A.S. 2	...	25	75	....	...	...	...	1	Grain	Grain	5 25	1 60
A 2	A.S. 5	...	25	75	.	..	...	....	1	"	Hay	5 25	1 30
A 3	A.S. 8	....	..	10	...	90	...	....	1	"	Corn	5 25	1 67
A 4	A.S. 11	....	...	20	...	80	..	....	1	"	Hay	5 25	1 30
	Aggregate								4	......	....	21 00	5 87
	Average per acre								1	..	....	5 25	1 47

FERTILIZER

B 1	A.S. 3	....	25	75	....	....	....	...	1	Grain	Grain	7 50	1 60
B 2	A.S. 6	...	5	85	...	10	....	...	1	"	Hay	7 50	1 30
B 3	A.S. 9	..	....	...	...	100	.	...	1	"	Corn	7 50	1 67
B 4	A.S. 12	....	..	50	...	50	.	...	1	"	Hay	7 50	1 30
	Aggregate								4	....	....	30 00	5 87
	Average per acre								1	....	....	7 50	1 47

FERTILIZER

C 1	A.S. 4	.	25	75	.	..	....	...	1	Grain	Grain	6 60	1 60
C 2	A.S. 7	....	....	70	..	30	....	....	1	"	Hay	6 60	1 30
C 3	A.S. 10	....	....	....	....	100	...	...	1	"	Corn	6 60	1 67
C 4	A.S. 13	..	....	30	....	...	20	50	1	"	Hay	6 60	1 30
	Aggregate								4	....	......	26 40	5 87
	Average per acre								1	....	....	6 60	1 47

'A.'—This rotation is four years' duration and includes grain, hay two years, roots or corn. The grain follows roots or corn, the land being ploughed or cultivated in the fall after the hoed crop is harvested. With the grain is sown 8 lbs. red clover, 2 lbs. alsike and 12 lbs. timothy per acre. The clover hay is cut twice in the season. In the second hay year two crops are cut if possible. Then the land is manured at the rate of 15 tons barnyard manure, per acre, and ploughed in August 5 inches deep, worked at intervals during the autumn and ribbed up in the late fall. The following spring the land is worked into a good tilth and sown to roots or corn.

'B.' This rotation is of four years' duration and includes grain, hay two years, roots or corn. The grain follows roots or corn, the land being ploughed or cultivated in the fall after the hoed crop is harvested. With the grain is sown 8 lbs. red clover, 2 lbs. aliske and 12 lbs. timothy per acre. The clover hay is cut twice in the season. In the second hay year two crops are cut if possible. Then the land is ploughed in August 5 inches deep and worked at intervals during the autumn and ribbed up in the late fall. The following spring the land is worked into a good tilth and 300 lbs. superphosphate, 75 lbs, muriate of potash and 100 lbs. nitrate of soda is applied before being sown to roots or corn. In

ROTATION 'A.'

OF EXPENSE IN RAISING CROP IN 1909. PARTICULARS OF CROP IN 1909.

Manual labour.		Horse labour.												
Hours.	Cost of manual labour.	Hours, single horse.	Hours with team.	Value, horse labour.	Threshing.	Total cost.	Cost for one acre.	Grain.	Straw.	Hay.	Roots and ensilage.	Total value.	Value of crop per acre.	Profit per acre in 1909.
No.	$ cts.	No.	No.	$ cts.	$ cts.	$ cts.	$ cts.	Lbs.	Lbs.	Lbs.	Lbs.	$ cts.	$ cts.	$ cts.
3	50	½	10¼	3 65	1 07	12 07	12 07	1,455	2,725	......	....	20 00	20 00	7 93
4½	75	½	11	3 83	.. .	11 13	11 13	....	....	3,890	.... .	13 61	13 61	2 48
26	4 30	2½	18	6 49	......	17 71	17 71	......	......	.... ..	26,540	26 54	26 54	8 83
6	1 00	½	12	4 13	......	11 68	11 68	......	.. ...	5,350	....	18 73	18 73	7 05
39½	6 55	4	51¼	18 10	1 07	52 59	52 59	1,455	2,725	9,240	26,540	78 88	78 88	26 29
9 8	1 64	1	12·8	4 52	27	.... .	13 15	364	681	2,310	6.635	......	19 72	6 57

ROTATION 'B.'

3	50	½	10¼	3 65	1 18	14 43	14 43	1,615	2,735	......	... ...	21 61	21 61	7 18
4½	75	½	11	3 83	.. ...	13 38	13 38	...	......	3,675	.....	13 56	13 56	18
26	4 30	2½	18	6 49	.. .	19 96	19 96	. .	.. ...	....	28,290	28 29	28 29	8 83
6	1 00	½	12	4 13	..	13 93	13 93	......	.. ...	5,530	.. ...	19 35	19 35	5 42
39½	6 55	4	51¼	18 10	1 18	61 70	61 70	1,615	2,735	9,205	28,290	82 81	82 81	21 11
9·8	1 64	·1	12 8	4 52	29	.....	15 42	404	684	2,301	7,072	....	20 70	5 28

ROTATION 'C.'

3	50	½	10¼	3 65	1 15	13 50	13 50	1,576	2,789	....	....	21 33	21 33	7 83
4½	75	½	11	3 83	......	12 48	12 48	......	.....	3.722	....	13 02	13 02	54
26	4 30	2½	18	6 49	......	19 06	19 06	.. .	......	....	26,445	26 44	26 44	7 38
6	1 00	½	12	4 13	.....	13 03	13 03	......	......	6,435	....	22 51	22 51	9 48
39½	6 55	4	51¼	18 10	1 15	58 07	58 07	1,576	2,789	10,157	26,445	83 30	83 30	25 23
9·8	1 64	·1	12·8	4 52	28	......	14 51	394	697	2,539	6,611	....	20 82	6 31

addition to the above the land receives a dressing of 100 lbs. nitrate of soda per acre each year that the field is in hay or grain. This application is given in early spring on the grass and just as the grain is coming through, when under grain.

'C.'—This rotation is four years' duration and includes grain, hay two years, roots or corn. The grain follows roots or corn, the land being ploughed or cultivated in the fall after the hoed crop is harvested. With the grain is sown 8 lbs. red clover, 2 lbs, alsike and 12 lbs. timothy per acre. The clover hay is cut twice in the season. In the second hay year two crops are cut if possible; then the land is manured at the rate of 7½ tons barn-yard manure per acre and ploughed in August 5 inches deep, worked at intervals during the autumn and ribbed up in the late fall. The following spring the land is worked into a good tilth and 150 lbs. superphosphate. 37½ lbs. muriate of potash and 50 lbs. nitrate of soda is applied before being sown to roots or corn. In addition to the above the land receives a dressing of 100 lbs. nitrate of soda per acre each year that the field is in hay or grain. This application is given in early spring on the grass and just as the grain is coming through, when under grain.

MINOR DATA COLLECTED, 1909.

Ploughing.

1. Ploughing one acre with simple plough cost.. .. ..$ 2 00
Ploughing one acre with two-furrow gang cost.. .. .. .. 1 25

Disc Harrowing.

2. Discing one acre with small disc (3 cuts necessary).. .. 0 90
Discing one acre with large disc (2 cuts necessary).. .. .. 0 80
Discing one acre with cutaway (1 cut necessary).. .. .. 0 45

Cost of Seeding.

3. Seeding one acre, two-horse seeder, cost.. .. .. 0 22½
Seeding one acre, three-horse seeder, cost.. .. .. 0 18

Space between rows of grain.

4. One acre sown with 6-inch markers, single disc drill, yielded 15,779 lbs. of grain (oats), 24,586 lbs. straw.

One acre sown with 7-inch markers yielded 16,079 lbs. of grain, 26,896 lbs. straw.

Cost of cutting hay.

5. Cutting one acre of hay with 4½-foot cutting bar.. .. .. ..$ 0 31
Cutting one acre of hay with 6-foot cutting bar.. .. .. .. 0 20
Cutting one acre of hay with 7-foot cutting bar.. .. .. .. 0 18

Cost of cutting grain.

6. Cutting one acre of grain with 6-foot binder, cost.. .. .. 0 28
Cutting one acre of grain with 8-foot binder, cost.. .. .. 0 20
(Three horses used on each machine.)

Man versus Machine for cutting corn.

7. It required 12 hours time of man to cut one acre of corn in hills (3 x 3.)
It required two hours time of (three-horse team) harvester to cut one acre of corn in rows 3½ apart.

Sowing Corn.

8. After land was prepared it cost 64 cents to mark and hand plant in hills (3 x 3) one acre of corn. After land was prepared it cost 20 cents to sow one acre with large seeders in rows 3½ feet apart.

Cultivating Roots.

9. It cost 62 cents per acre to cultivate roots with single cultivator (once over) It cost 45 cents per acre to cultivate roots with double cultivator (once over).

Methods of Sowing Turnips.

10. Turnips sown on the flat yielded 61,640 lbs. per acre. Turnips sown on drills yielded 55,392 lbs. per acre. Turnips sown 2 feet apart in rows yielded 56,008 lbs. per acre. Turnips sown 2½ feet apart in rows yielded 61,024 lbs. per acre.

REPORT OF THE HORTICULTURIST

W. T. MACOUN.

OTTAWA, March 31, 1910.

Dr. WM. SAUNDERS, C.M.G.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith the Twenty-third Annual Report of the Horticultural Division.

In this report will be found information in regard to that part of the work of the Division which it was thought desirable to deal with this year.

I have the honour to be, sir.

Your obedient servant,

W. T. MACOUN,

Dominion Horticulturist.

CHARACTER OF SEASON.

In the Annual Report of the Horticulturist for last year, a record was published of the dates when the frost was out of the ground sufficiently and the ground dry enough to dig in the nursery at the Central Experimental Farm. The average date for the eleven years, 1898-1908, was April 11, or leaving out two very exceptional years, the average for nine years was April 15. It is interesting to know the dates when winter set in during the past twelve years, for which time a record has been kept in the Horticultural Division. The dates are those when ploughing was no longer possible, either because of frost or snow. The record is as follows: 1898, November 26; 1899, December 4; 1900, November 13; 1901, November 14; 1902, November 25; 1903, November 16; 1904, November 24; 1905, November 27; 1906, November 26; 1907, November 25; 1908, December 1; 1909, November 22. The average date for the twelve years was thus November 24.

By April 6, 1909, the ground was bare of snow in places, and by the 13th the snow was about gone and the frost was sufficiently out of the ground to use the spade in the nursery, though the soil was still rather wet. April was a cool month, the lowest temperature being 14·5° F. on the 10th, and the highest 64° F. on the 13th. There was frost on twenty-three days. Precipitation was well distributed during the month. On the 30th there was a heavy snowstorm, followed by rain. The last spring frost was on May 4, when the temperature was 30·5° F., the lowest temperature during the month. The highest temperature was 75·5° F. on the 14th. May was a cool month also. There were frequent showers during the month. The blooming season of fruit trees was very late. The weather was only moderately warm in June, although the temperature rose on the 22nd to 91·8° F. The nights were cool. But little rain fell during the early part of the month, and by the 12th the need of more rain was becoming apparent, but heavy rain on the night of the 13th wet the ground well. By the end of June, vegetation was still backward, though

most things were looking well. A number of the apple trees became badly infested with aphis near the end of June. July was only moderately warm and most of the nights were cool. There were no long spells of hot weather. The highest temperature was on the 15th, when the temperature rose to 89·8° F. The rainfall was well distributed through the month. The days in August were warm, on the whole, but the nights, as in the early part of the summer, were comparatively cool. The hottest period of summer was from the 2nd to the 9th, when the maximum temperatures ranged from 82·4° F. to 95·4° F. The warmest day of the summer was on August 25, when the temperature was 95·6° F. There was a bad infestation of aphis on potatoes in August. The apple aphis also continued plentiful until about the middle of the month, or about the time when the last spraying was made for them.

In September, the days were moderately warm and the nights cool. No frost was recorded in September, the lowest temperature being 36° F. on the 29th. The shot-hole fungus was very injurious to plum trees in September, notwithstanding thorough spraying. A considerable quantity of plums burst on the trees, apparently due to the wet weather when the fruit was ripening. October was a fine month. The first autumn frost occurred on October 13, when the temperature was 29·8° F. The leaves of tender plants were killed where exposed to the morning sun, but in shady places they were but slightly injured. The first killing frosts were on October 20 and 21, up to which time the tenderer plants were still alive. There was an abundance of rain in November, thoroughly wetting the ground before winter set in on November 22 with about two inches of snow on the ground, which was slightly frozen. There was no good sleighing until December 7. December, January and February were exceptionally fine winter months, with comparatively high temperature. During these months the temperature was below zero but 18 times. The coldest day of the winter was on February 7, when the temperature was 19·4° F. below zero. Several thaws of short duration occurred during the winter, but, although the snow was never more than from fifteen to eighteen inches deep, the ground did not become bare until the end of February, when it began to show in places. March was a fine month with little precipitation, and, although the temperature fell below zero twice, it was above freezing on twenty-five days, making a mild month with the highest temperature 69·5° F on the 29th. By March 21 there was little snow left except where drifts had been. By the 28th the ground was dry enough to dig in parts of the nursery and the frost out except in a few spots. The upper part of the orchard could also be ploughed on this date. The winter of 1909-10 has been one of the most favourable for fruits that has been experienced at the Central Experimental Farm.

FRUIT AND VEGETABLE CROPS.

While the crops of some kinds of fruit were not more than medium in 1909, there was, as a rule, an abundant supply of good quality. The apple crop was a fair one, on the whole, in the province of Ontario, although the crop of summer apples was comparatively light. In the province of Quebec the crop was below medium. There was more codling moth than usual, and the apple aphis did much damage, but the apple spot was not so injurious as in some seasons. Apples were smaller than the average owing to a late spring, to dry weather in some places, and to the apple aphis in others. The pear crop was light to medium with fruit of good quality. Plums were a medium to good crop. Peaches medium to good and of good quality. In Southwestern Ontario the cherry crop was good both in quantity and quality. There was a good crop of grapes, but, owing to the low price obtained, the revenue to the growers was comparatively small. The crop of bush fruits was good both in Ontario and Quebec. The strawberry crop promised to be a large one, but was reduced somewhat by the dry weather, hence was not more than a medium one.

At the Central Experimental Farm there was a fair crop of apples of good quality, practically free from apple spot and comparatively little injured by codling moth. There were but few European plums, as usual. The crop of Americana and Nigra varieties was medium. There were practically no cherries. The crop of grapes was a fair one and many varieties ripened well. There were good crops of raspberries, currants and gooseberries.

Most vegetables gave good crops in Ontario and Quebec in 1909. The potato crop in both provinces was better than the average. At Ottawa it was good where new seed was used, but from seed which had been weakened in vitality by drought during the previous three seasons the yield was poor.

MEETINGS ATTENDED, PLACES VISITED AND ADDRESSES GIVEN.

As usual, quite a number of meetings were attended during the past year and addresses were given at most of them.

On April 3, 1909, an address was given before the Perth Horticultural Society on 'The Flower Garden;' Renfrew Farmers' Institute at Burnstown, Ont., June 23, 1909, on 'Fruit Culture;' summer meeting of the Quebec Pomological Society, La Trappe, Que., on August 24 and 25, 1909, 'The Best Remedies for the Most Injurious Insects and Fungous Diseases Affecting Fruits;' biennial meeting of the American Pomological Society, St. Catharines, Ont., September, 14-17, 1909, 'Grape Growing in the Colder Districts;' annual meeting of the Society for Horticultural Science, St. Catharines, September 13, 1909, 'Overcoming Winter Injury;' annual meeting of the Ontario Fruit Growers' Association, Toronto, Ont., November 10-11, 1909, 'Report on New Fruits' and 'A More Uniform System of Judging Fruits for Eastern Canada;' annual meeting of the Canadian Horticultural Association, Toronto, Ont., November 10-11, 1909, 'Some of the Best Native Plants for Cultivation;' annual meeting of the Ontario Vegetable Growers' Association, Toronto, Ont., November 11, 1909, 'Potato Culture with Especial Reference to the Importance of Using Seed of Strong Vitality;' annual meeting of the Ontario Horticultural Association, Toronto, Ont., November 10, 1909, 'Report on Novelties;' annual meeting of the Quebec Pomological Society, Macdonald College, Que., December 9-10, 1909, 'Plum Culture in the Province of Quebec;' meeting of the St. Catharines Horticultural Society, March 31, 1910, 'The Intelligent Care of Garden Plants.'

Addresses were also given in connection with short courses at the Agricultural College, Truro, N.S., and at the Ontario Agricultural College, Guelph, Ont. At Truro, on January 5-6, 1910, the subjects were: 'Some Things it is Necessary to Know When Establishing an Orchard,' 'The Culture of Small Fruits for Home and Market,' 'The Culture of Vegetables for Home and Market.' At Guelph, January 28-29, 1910, on 'The "Why" of Orchard Cultivation,' 'Grape Growing in Northern Sections,' and 'Market Requirements.'

While attending the meeting of the American Pomological Society in September I had the opportunity of visiting a number of the orchards in the Grimsby, St. Catharines and Niagara River sections of the Niagara peninsula and learned as much as I could at that time of the methods of the fruit growers there and of the crops which they were growing. In August I attended a meeting of the advisory board of the Fruit Experiment Stations of Ontario at the Horticultural Experiment Station at Jordan Harbour, and, while there, learned something of the experimental work being carried on at that institution. The Toronto Exhibition was attended on September 7, when I judged part of the collection of fruit there. On October 5, 6 and 7, I was at the Nova Scotia Horticultural Exhibition at Middleton, N.S., and judged a large collection of fruit. While in Nova Scotia at that time, I took the opportunity of seeing as much as possible of fruit and fruit culture in the Annapolis valley, including a visit to the cranberry bogs near Auburn.

ACKNOWLEDGMENTS.

During the past year I have been ably assisted in the Horticultural Division by those who have charge of the various branches of the work, and I have much pleasure in taking this annual opportunity of acknowledging the services of Mr. J. F. Watson, secretary; Mr. H. Holz, foreman to the Horticultural Division; Mr. F. Horn, foreman in the arboretum and botanic garden, and Mr. Horace Reid, foreman in the orchards and vegetable plantations. I desire also to express my appreciation of the faithful work of the other men employed in the Horticultural Division.

To those in Canada and in other parts of the world who, through their kindly interest and assistance by correspondence and donations of plants and seeds, have helped to make the work of this Division effective, I also feel much indebted.

DONATIONS.

This occasion is taken to publicly acknowledge the receipt of the many interesting things which were donated to the Horticultural Division during the past year, and to express our appreciation of the kindness of those who have contributed to the value of the work in this way. Following is a list of the seeds, plants, &c., which were donated:—

SENDER.	DONATION.
Ames, Experiment Station, Ia., U.S.	Seeds of *Pyrus Ioensis*. Scions: Evaline, Summer strawberry, Delavan, Red June, Colorado Orange, and Fall Orange apples.
Attridge, H., London West, Ont.	Squash seed.
Ball, J. Raymond, Knowlton, Que.	Danish Roundhead and Burpee's New Fordhook muskmelon. Early Wonder Sweet and Tait's Early White flint corn, ears.
Barrett, P., Truro, N.S.	Potato seedling.
Bonewall, Geo. L., North Augusta, Ont.	Potatoes, Leeds Beauty.
Brodie, Robert, Westmount, Que.	Scions of two seedling apples. Seed of Paul Rose melon and of large melon.
Carter, Jas. H., Abbotsford, Que.	Scions of Victoria apple.
Castleman, J. H., Langley Prairie, B.C.	May Wonder potato.
Cooper & Nephews, Toronto, Ont.	1 gallon each of V-2 and V-3 spray
Delworth, Thos., Weston, Ont.	Nitro Bacterine for onions.
Ferwell, W. E., Orillia, Ont.	Potato seedling.
Foyston, F., Minesing, Ont.	Scions of Bird Cherry.
Francis, D., Perth, Ont.	Cuttings of European grape.
Fuller, Mr., Aylmer, Que.	Scions, apple.
Geneva Experiment Station, N.Y., U.S.	Scions, Red June apple, 12 plants Lonboro, Marlative, and June raspberries.
Grant, H. N., Newtonbrook, Ont.	Scions, seedling apple.
Harkness, A. D., Irena, Ont.	Scions of Red Fameuse apple.
Harner, G. S. W., Arlington Beach, Sask.	Harner Delight potato.
Hawkings, J., Ridgetown, Ont.	French Monarch potato.
Heikel, B. W., Lantbrukstyrelsen, Helsingfors, Finland	Apple and pear scions.
Hitchcock, G. P., Massawippi, Que.	Scions of seedling apple.
Howard & Son, Belchertown, Mass., U.S.	12 plants No. 17 seedling strawberry.
Johnson, J. E., Simcoe, Ont.	Scions of Strawberry King apple.
Johnston, J. W., Campbellford, Ont.	Gooseberry, raspberry and strawberry plants.
Jones, Harold, Maitland, Ont.	Scions of Red Fameuse apple and seedling pear.
Lafer, J. W., Catawba Island, Ohio, U.S.	Plant food.
Laughton, W., Lancaster, Ont.	Mushrooms.
Lyons, Wm. J., Millbrook, Man.	Potatoes, Michigan Rose.
McCluskey, R. A., Dawson, Yukon Territory	Gold Nugget and McCluskey potatoes.
McLean, C., Burton, N.B.	Scions of Burton apple.
Moore, W. H., Scotch Lake, N.B.	Scions of seedling apple.
Morrow, J. F., Calumet, Que.	Scions, apple.
Newman, C. P., Lachine Locks, Que.	Plants of wild blackberry. Seedling raspberry. 24 plants Meade strawberry.
Niven, R. B., Toronto, Ont.	Wild plants.
Reid, Peter, Chateauguay Basin, Que.	Apple scions.
Ryer, Ralph H., Sand Beach, N.S.	Plants, seedling strawberry.

SENDER.	DONATION
Roe, T. W., Looma Vista, Alta..	Potatoes, seedling.
Rowbottom, Frank E. K., Fartown, Sask.. ..	Genessee Flat potato.
Rowley, Jos., Cummings Bridge, Ont..	Scions, Joseph Plum
Saunders, W. E., London, Ont..	Ginseng seed.
Scott, Chas., Elpinstone, Man..	Epicure potato.
Shaw, Prof. Percy J., Truro, N.S..	Black beans.
Smith, Arthur, Riverview Nursery Co., Woodstock, Ont..	1 pound each of Satisfaction and Veribest potatoes.
Smith, A. D., Glendale, N.S..	Potatoes, Blue, and Pink seedling.
Snelling, W. H., Rockliffe Park, Ont..	Seed of White Delphinium.
Sutton & Sons, Reading, England..	1 pound Sutton's White City potato.
Taylor, H. A., Vermilion, Alta..	Potatoes.
Washington, U.S., Bureau of Plant Industry..	Apple scions.
White, Mrs. Annie G. H., Toronto, Ont.. ..	*Monarda didyma* and *Epipactis plants*. One plant *Epigaea*.
Wilmot, Henry, Oromocto, N.B..	Scions of Belmont apple.
Wilson, A. E., Clarence, Ont..	Wild plums.
Wootton, T. H., Wellman's Corners, Ont.	Scions of Crown apple.

PLANT DISEASES.

When the Experimental Farms were organized, part of the work undertaken by the Botanist was the investigation of plant diseases. This work was continued by the Botanist until 1894, when the Horticulturist, who had been conducting most of the experiments for the control of fungous diseases, was given charge of the entire work with plant diseases. Dr. James Fletcher, Entomologist and Botanist, states in his annual report for 1894 (page 183): 'In accordance with an arrangement made last spring, the work upon parasitic fungous diseases is now carried on by Mr. Craig, the Horticulturist.' From 1894 until this year, the Horticulturist has thus dealt with the work in connection with plant diseases. During the past fifteen years, many specimens of diseased plants have been sent to the Horticulturist for name, and in most cases he has been able to identify the disease and give the necessary information for its control. With his many other duties, however, it was not possible for him to thoroughly investigate all the diseases brought under his notice. From 1890 to 1897, Mr. John Craig was Horticulturist of the Central Experimental Farm, since which time the writer has held that position. On the appointment of Mr. H. T. Güssow as Botanist to the Experimental Farm in 1909, the work in plant diseases was transferred again to the Botanical Division.

In the reports and bulletins which the Horticulturist has prepared during the past twenty years the following diseases have been discussed or described, many of the diseases having been dealt with a number of times:—

APPLE.—Fire Blight, *Bacillus amylovorus* (Burr.) De Toni; Dry Rot, Brown Spot, or Baldwin Spot; Core Rot; Black Spot or Scab, *Venturia Pomi* (Fr.) Wint.= (*Fusicladium dendriticum*, Fckl.); Sooty Fungus, Fly Speck Fungus, *Leptothyrium Pomi* (Mont. & Fr.) Sacc.; Bitter Rot, Ripe Rot, *Glomerella rufomaculans* (Berk) Spauld and Von Schr.; Crown Gall.

CHERRY.—Brown Rot, Ripe Rot, *Sclerotinia fructigena* (Pers.) Schroet,=(*Monilia fructigena* Pers.); Black Knot, *Plowrightia morbosa*, (Schw.) Sacc.

CURRANT.—Leaf Spot, Rust, *Septoria Ribis*, Desm.; Currant Anthracnose *Gloeosporium Ribis* (Lib.) Mont. & Desm.

GOOSEBERRY.—Powdery Mildew, *Sphaerotheca Mors-uvae* (Schw.) B. & C.,; Leaf Spot, Rust, *Septoria Ribis*, Desm.

GRAPE—Anthracnose, Bird's-Eye Rot, *Gloeosporium ampelophagum* Sacc. (*Sphaceloma Ampelinum* De Bary.); Black Rot, *Guignardia Bidwellii* (Ell.) Viala

& Rav.; Downy Mildew, Brown Rot, Gray Rot, *Plasmopara Viticola* (B. & C.) Berl. = (*Peronospora viticola* De Bary.); Leaf Blight, *Cercospora Viticola* Sacc.; Powdery Mildew, *Uncinula necator* (Schw.) Burr.

Peach.—Brown Rot, Ripe Rot, *Sclerotinia fructigena* (Pers.) Schrt. = (*Monilia fructigena* Pers.); Mildew, *Sphaerotheca pannosa* (Wallr.) Lév.; Leaf Curl, *Exoascus deformans* (Berk), Fuckel.; Black Spot, *Cladosporium carpophilum* Thüm; Yellows.

Pear.—Core Rot; Leaf Blight, Pear Cracking, *Entomosporium maculatum* Lév.; Fire Blight, *Bacillus amylovorus* (Burr.) De Toni.

Plum.—Shot-hole Fungus, *Cylindrosporium Padi* Karst.; Brown Rot, Ripe Rot, *Sclerotinia fructigena* (Pers.) Schart. (*Monilia fructigena* Pers.); Pockets, *Exoascus Pruni* Fuckel; Spot or Blight of the Native Plum, *Cladosporium carpophilum* Thüm.: Black Knot, *Plowrightia morbosa* (Schw.) Sacc.

Raspberry.—Anthracnose, Cane Rust, *Gloeosporium Venetum* Speg; Orange Rust, *Gymnoconia Peckiana* (Howe) Tranz. (*Cœoma nitens* Schw.); Cane Blight, *Coniothyrium* (Fckl.) Sacc.; Leaf Spot, *Septoria Rubi* West; Yellows.

Strawberry.—Leaf Blight, Rust, *Mycosphaerella Fragariæ* (Tul.), Lindau (*Sphaerella Fragariae* Sacc.); Powdery Mildew, (*Spaerotheca Humuli* DeC. (*Sphaerotheca Castagnei* Lév.)

Vegetables.

Asparagus.—Rust, *Puccinia Asparagi* De C.

Bean.—Anthracnose, *Cottetotrichum Lindemuthianum* (Sacc. & Magn.) Scribner.

Cabbage.—Black Rot, *Pseudomonas campestris* (Pammel), Erw. Smith.

Celery.—Leaf Spot, Leaf Blight, Early Blight, *Cercospora Apii* Fr.; Late Blight. Rust, *Septoria Petroselini* Desm. var. *Apii* Br. & Cav.

Onion.—Blight, Downy Mildew, *Peronospora Schleideniana* De Bary.

Potato.—Early Blight, Leaf Blight, *Alternaria Solani* (E. & M.) Jones & Grant; Late Blight, Rot, *Phytophthora infestans* (Mont.) De Bary; Scab, *Oospora scabies* Thaxter.

Tomato.—Black Rot, *Macrosporium tomato,* Cooke.

Flowers.

Carnation.—Rust *Uromyces caryophyllinus* (Schrank) Wint.

Iris.—*Heterosporium gracile* Sacc.

Rose.—*Mucor.*

Violet.—Leaf Blight, Leaf Spot, *Cercospora Violae* Sacc.

Fungous Parasite of San José Scale, *Sphaerophila coccophila.*

SEEDLING FRUITS OF CANADIAN ORIGIN RECEIVED FOR EXAMINATION DURING 1909-10.

There was quite a number of seedling fruits received for examination during 1909-10, although the proportion of promising seedlings was less than usual. Descriptions were made of nearly all the fruits which were received. In the following table

the descriptions of the least promising are given in part, while, following the table, fuller descriptions are published of those considered most promising.

The Horticulturist will be glad to examine and report upon seedlings thought to have decided merit, but, as there are so many good named varieties now on the market, a new seedling must have some outstanding advantages over the older sorts to be considered promising. While new seedlings may be no better than the named varieties in most respects, they may be hardier, which would make them promising for the colder sections:—

SEEDLING FRUITS RECEIVED FOR EXAMINATION IN 1908-9.

Record Number.	Province.	Name and Address of Grower or Sender.	Description of Fruit.
449	Nova Scotia.	W. C. Douglas, Alma. .	See full description.
450	" ..	E. K. Leonard, Paradise	Above medium size; roundish conical, slightly ribbed; pale green splashed and washed with dull red; subacid, little flavour; quality above medium; season October. Not promising.
451	" ..	" " ..	See full description.
452	" ..	R. M. McRae, West Bay	Crab apple; medium size; oblate, flattened at ends; rich yellow, subacid; slightly astringent, little flavour; quality medium. Season evidently mid to late September. Does not compare favourably with best named crab apples.
453	New Brunswick.	Tappan Adney, Upper Woodstock.	No. 1—Below medium size; roundish, very slightly ribbed; yellow well washed with orange red and purplish red; subacid, little flavour; quality medium; season probably early to late winter. Not specially promising.
454	" ..	" " ..	No. 2—Below medium size; oblate to roundish; yellow washed with orange red and dark purplish red splashes briskly subacid, slightly astringent, little flavour: quality;medium; season evidently early to late winter. Not specially promising.
455	" ..	" " ..	No. 3—Medium size; oblate to roundish, slightly ribbed; yellow splashed and washed with orange red with darker purplish red splashes; subacid, pleasant, but not high flavoured; quality above medium; season evidently early to late winter. Not specially promising.
456	" ..	C. H. Palmer, Middle Simonds.	No.1—Medium size; roundish; pale yellow, sometimes with a faint pink blush on sunny side; acid, little flavour; quality medium; season evidently October. Not promising.
457	" ..	" " ..	No.2.—Medium size; oblate; pale greenish-yellow thinly splashed with purplish red; briskly subacid, little flavour; quality medium; season probably late October to December. Not promising.
458	Quebec.	Jos. Cloutier, Riviere aux Chiens.	Large; roundish, ribbed; greenish-yellow with a pinkish blush on sunny side; briskly subacid, somewhat astringent, little flavour; quality medium; season probably late September to mid October. Grown by Joseph Simard, Beaupré, Que. Not promising.
459	"	Thos. Graham, Wyman..	Medium size; roundish; yellow, splashed and streaked with bright red; subacid, pleasant but not high flavour; quality above medium to good; season probably October. Not sufficiently promising.
460	"	G. D. Hodgson, Hudson.	Large, roundish conical; slightly ribbed; greenish-yellow washed with deep-purplish red and splashed with dark crimson; briskly subacid, little flavour; quality medium; season late October, probably to December. Not promising.
461	"	" " ..	Medium size; roundish, slightly ribbed; very dark crimson; subacid, flavour somewhat Fameuse-like; quality above medium; season evidently late October to early or mid winter. Not good enough in quality.
462	" ...	N. Jean, L'Ange Gardien, Montmorency Co.	Small, roundish, regular; yellow, well washed with dark crimson; subacid, pleasant but not high flavour; quality good; season probably late October to December. Too small.
463	" ...	Jules Lagacé, St. Louis Church, Témiscouata.	Below medium size; roundish; pale greenish-yellow with a dull red blush on sunny side; subacid, little flavour; quality medium; season evidently late October, probably through November. Not sufficiently promising.

SEEDLING FRUITS RECEIVED FOR EXAMINATION IN 1908-9—*Continued.*

Record Number.	Province.	Name and Address of Grower or Sender.	Description of Fruit.
464	Quebec....	Hugh McLatchie, West Templeton.	Below medium to medium, roundish; pale, waxy-yellow well splashed and streaked with bright red; briskly subacid; little flavour; quality above medium. Season mid to late August. Attractive but rather small.
465	"	Peter Reid, Chateauguay Basin.	Medium size; roundish; pale, greenish-yellow, splashed and washed with crimson; subacid, pleasant flavour; quality good; season evidently early October.
466	"	Peter Reid, Chateauguay Basin.	Above medium size; oblate conic; pale green washed with deep crimson; subacid, peculiar flavour; quality above medium; season October. Peculiar flavour is against it.
467	"	J. A. Roussin, Oka......	Above medium size; conical; yellow, splashed and streaked with purplish-red; subacid, pleasant but not high flavour; quality above medium; season evidently mid to late September. Not sufficiently promising.
468	Ontario.....	H. C. Aikman, Washago.	Large; roundish; pale green, thinly splashed and washed with carmine; subacid, little flavour; quality above medium; season probably October. Not attractive enough nor good enough in quality.
469	"	Wm. Bishop, Guelph....	See full description.
470	"	John Dunlop, Union Hall.	See full description.
471	"	H. Hilborn, Bosworth...	Medium size; roundish; yellow, splashed and washed with carmine; subacid, pleasant flavour, quality good; season October. Water-cores. Not promising.
472	"	Wm. Hutchings, sr., Haliburton.	Below medium size; roundish; pale yellow, washed and splashed with crimson; subacid, pleasant, not high flavour; quality above medium; season evidently November. Not promising except perhaps locally.
473	"	Wm. Hutchings, Haliburton.	Below medium size; oblate conic; yellow; washed with pinkish red on sunny side; sweet, but not high flavour; quality above medium; season evidently November to late winter. Not promising except for where better kinds will not succeed.
474	"	W. J. Kerr, Ottawa.....	Above medium size; oblate conic; pale green splashed and washed with deep crimson; briskly subacid, little flavour; quality medium; season early to late September. Quality not good enough.
475	"	Wm. Loney, Kenmore..	Medium to above medium size; oblate, flattened; pale greenish yellow, sometimes with a trace of pinkish-red on sunny side; subacid, sprightly, slightly astringent; quality above medium; season evidently late November to probably through the winter. Not attractive enough in appearance, nor good enough in quality.
476	"	John McKay, Creemore.	See full description.
477	"	John McKay, Creemore.	Medium size; roundish; pale, greenish-yellow washed and splashed with crimson; subacid, pleasant; quality above medium to good; season Novomber and December. Not as good as No. 476.
478	"	John McKay, Creemore.	Below medium size; roundish conic; green; subacid, little flavour; quality medium to above medium; season late November and later. Not promising.
479	"	Edwin Peart, Nelson....	'Homestead.' See full description.
480	"	Dr. Geo. Sherk, Cheapside.	'Euphemia.' Medium size; oblate ribbed; greenish yellow, splashed and striped with red on sunny side; acid, little flavour; quality medium to above medium; season evidently September. Not promising.
481	" ..	Dr. Geo. Sherk, Cheapside.	'Mary'. Large; roundish conic; pale yellow, almost entirely covered with crimson; briskly subacid, pleasant but somewhat astringent; quality above medium to good: season evidently early September. Astringency is against it.
482	" ..	Dr. Geo. Sherk, Cheapside.	'Harriette'. Medium size; roundish; greenish-yellow washed with crimson on sunny side; subacid, little flavour; quality above medium; season probably late September to November or later. Not sufficiently promising.

SEEDLING FRUITS RECEIVED FOR EXAMINATION IN 1908-9.—*Concluded.*

Record Number.	Province.	Name and Address of Grower or Sender.	Description of Fruit.
483	Ontario. ..	C. L. Stephens, Orillia..	No. 1. Above medium size; oblate conic; greenish-yellow or yellow, well splashed and washed with carmine; briskly subacid, pleasant flavour but astringent: quality above medium; season September and later. Not sufficiently promising.
484	" ..	C. L. Stephens, Orillia..	Medium size; roundish conical, ribbed; yellow, pinkish on sunny side; briskly subacid, not high flavour; quality above medium; season mid to late winter. Not juicy enough nor good enough in quality.
485	" ..	J. Woodhouse, Guelph	See full description.
486	" ..	J. Woodhouse, Guelph..	Medium; roundish; green, washed with dull bronzy red on sunny side, subacid, pleasant flavour; quality above medium to good. Season evidently late November through the winter. Not good enough in quality nor attractive.
487	" ..	Mrs. Wm. Cummings, Spencerville.	See full description.
488	" ..	H. A. McIntosh, Dundela.	See full description.
489	British Columbia.	W. G. Barclay, Nelson..	Large; oblate conic, sides unequal, pale yellow, thinly splashed with purplish red on sunny side; briskly subacid, little flavour; quality above medium; season evidently September to early October. Past best condition, but does not seem good enough in quality.
490	" ..	W. S. Clark, Keefers....	No. 1. Very large; roundish conical, ribbed; pale green washed with dull red; sweet: quality medium to above medium; season evidently October. Not of especial merit.
491	" ..	W. S. Clark, Keefers....	No. 2. Medium; oblong conical, flattened at apex; yellow, splashed and streaked with carmine; briskly subacid, little flavour; quality medium; season evidently October. Not promising.
			PLUMS.
492	Quebec.	Slack Bros., Waterloo...	Below medium size; yellow nearly covered with red. A very late variety. Past best condition. Nigra group.
493	Ontario......	A. D. Harkness, Irena..	See full description.
494	" ..	L. L. Livingston, Frankville.	Two seedlings, neither of which was promising. Americana group.
495	" ..	R. A. Marrison, Cataraqui	Kingston Sugar. See full description.
496	" ..	C. H. Snow, Cummings Bridge.	Large; oval; yellow, more or less covered with bright red; clingstone; sweet but somewhat astringent; quality above medium. Attractive, but too astringent to be promising. Americana group.
497	" ..	C. H. Snow, Cummings Bridge.	Seedling of Weaver. See full description.
498	" ..	C. H. Snow, Cummings Bridge.	Seedling of Hawkeye. Very large; roundish to oval, slightly flattened; yellow, sparingly splashed with bright red; sweet, somewhat astringent; quality above medium; attractive looking but not good enough in quality. Americana group.
499	" ..	A. E. Wilson, Clarence..	Medium size; roundish to somewhat heart-shaped; deep red all over. Moderately sweet and without astringency; quality above medium. Not specially promising but said to never blight. Nigra group.
			GOOSEBERRY.
500	Nova Scotia.	Peter Barret, Truro.....	Hortense. Size 1 to 1¼ in. by ⅞ to 1 in; oval to roundish: green; a very few prickles; quality medium.

449. Apple, seedless, from W. C. Douglas, Alma, Pictou county, N.S.—Small; roundish to oblong; cavity medium depth and width, russeted; stem long, slender; basin open, medium depth, wrinkled; calyx open; pale yellow with a red blush on sunny side; predominant colour pale yellow; dots obscure; skin thin, tender; flesh dull white, tender, breaking; core medium size, normal; briskly subacid, little flavour, moderately juicy, slightly astringent; quality medium; season October, evidently.

Quite seedless, but does not seem abnormal in any other way. More of a crab apple than an apple. Tree said to be about 75 years old.

451. Apple, seedling from E. K. Leonard, Paradise, N.S.—Medium size; oblate to roundish; cavity deep, medium width; stem short, moderately stout; basin medium depth and width, slightly wrinkled; calyx open; pale yellow, well washed with bright crimson; predominant colour, bright crimson; dots few, yellow, distinct; skin moderately thick, moderately tender; flesh white, very tender, juicy; core medium; subacid, pleasant, not high flavour; quality above medium; season evidently October.

A handsome apple of the Fameuse type.

469. Apple, seedling from Wm. Bishop, Guelph, Ont.—Medium size; oblong conical; cavity medium depth and width; stem short, moderately stout; basin deep, medium width; calyx open; yellow; predominant colour yellow; seeds medium; dots moderately numerous, grey, distinct; skin thin, moderately tender; flesh yellowish, tender, juicy, buttery; core above medium size, open; subacid, pleasant flavour; quality good; season evidently November and December.

Said to be a seedling of Bellflower, and better in quality than parent. It is good in quality and perhaps better than Bellflower, but too much like it to make it promising for propagating as a new sort. Worthy of further test.

470. Apple, seedling from John Dunlop, Union Hall, Ont.—Medium size, roundish; cavity medium depth and width; stem medium length, moderately stout; basin medium depth and width, slightly wrinkled; calyx open; splashed, streaked and washed with dark crimson; predominant colour dark crimson; seeds above medium, plump; dots obscure; skin moderately thick, moderately tender; flesh yellowish, tender, moderately juicy; core medium; subacid, pleasant flavour; quality good; season evidently September to November.

Supposed to be a seedling of Duchess. Said to be very hardy. 'A better keeper than Duchess,' November 13. Past condition now; may be useful coming between Duchess and Wealthy.

476. Apple, seedling from John McKay, Creemore, Ont.—Medium size; roundish; cavity medium depth and width; stem short, stout; basin deep, medium width, wrinkled; calyx closed; pale greenish yellow washed and splashed with crimson; predominant colour crimson; seeds large, long; dots white, distinct; skin thick, tough; flesh dull white, rather coarse, but crisp and juicy; core below medium; subacid, pleasant flavour; quality good; season mid November, probably to mid-winter.

A promising apple if hardier than most winter sorts. Flavour is much like Spy.

479. Apple, seedling from Edwin Peart, Nelson, Ont.—Named 'Homestead;' large; roundish conical, ribbed; cavity open, deep, russeted at base; stem medium length, moderately stout; basin deep, medium width, nearly smooth; calyx open; yellow, washed and splashed with pinkish red and carmine; predominant colour carmine; seeds medium size, plump; dots few, small, white, distinct; skin moderately thick, tough; flesh yellowish, tender, melting, juicy; core medium; subacid, pleasant flavour, but after-taste peculiar; quality good; season evidently early to mid-winter.

Very much like Northern Spy in outward appearance, in flesh, and slightly in flavour, but general flavour is different from Spy; after-taste not altogether pleasant. Probably a seedling of Spy. Grown on farm of E. Peart, and fruited for the first time this year. Promising.

485. Apple, seedling from J. Woodhouse, Guelph, Ont.—Above medium size; roundish; cavity medium depth and width, russeted; stem short, stout; basin medium depth and width, smooth; calyx open; yellow washed with orange red on sunny side; predominant colour yellow; seeds large; dots moderately numerous, yellow, distinct on sunny side; skin moderately thick, tough; flesh yellowish, tender, moderately juicy; core medium; subacid, pleasant flavour; quality good; season evidently October and November.

Tree 10 years old. Bearing 3 years. Resembles Holland Pippin considerably. Handsome and rather promising.

487. Mrs. Wm. Cumming, Spencerville, Ont.—Medium size; oblate, cavity medium depth and width, russeted; stem medium length, slender; basin deep, medium width, smooth; calyx open; yellow washed and splashed with crimson; predominant colour, crimson; seeds medium size, broad; dots few, yellow, indistinct; skin thin, moderately tender; flesh dull white or yellowish, tender, breaking, juicy; core small; subacid, pleasant flavour; quality good to very good; season evidently mid-winter. Promising. Apple of Fameuse type.

488. Apple, seedling from H. A. McIntosh, Dundela, Ont.—Fruit, above medium size; oblong, conical, ribbed; cavity medium depth and width, russeted; stem short, stout; basin narrow, medium depth, wrinkled; calyx closed or partly open; yellow, well washed and splashed with rich crimson; predominant colour rich crimson; seeds numerous, above medium size; dots numerous, small, yellow, distinct; bloom, none on specimens examined; skin moderately thick, tough; flesh dull white or yellowish with traces of red, firm; moderately juicy; core large, open; flavour subacid, not high; quality above medium; season evidently mid to late winter.

Tree: Thought to be 'a cross between McIntosh and Salome.' Said to 'have the freshness and keeping quality of Salome, but a better bearer and tree as hardy as an oak.' An attractive looking apple, but not good enough in quality to be very promising.

493. Plum, seedling from A. D. Harkness, Irena, Ont.—Roundish to heart-shaped; medium size; cavity narrow, medium depth; suture distinct, slightly depressed; apex rounded; yellow, more or less washed with bright red; dots obscure; no bloom; skin moderately thick, tender; flesh yellow, juicy; stone medium size, oval, considerably flattened; flavour sweet, good, no astringency; quality good.

A good plum if larger. Nigra group.

495. Plum, Kingston Sugar, from R. A. Marrison, Cataraqui, Ont.—Heart-shaped; above medium size, $1\frac{1}{2}$ by $1\frac{1}{2}$ inches; cavity shallow, medium width; stem medium length; moderately stout; suture a distinct line, very slightly depressed; apex rounded; green with traces of yellow; dots indistinct; bloom moderate, bluish; skin moderately thick, moderately tough; flesh yellowish-green, juicy; stone medium size, oval, cling; flavour sweet, good; quality very good.

Said to be hardier than Lombard and some other sorts. A promising plum. Reine Claude group.

497. Plum, seedling of Weaver, from C. H. Snow, Cummings' Bridge, Ont.—Oval, slightly flattened; large; cavity shallow, open, suture a distinct line, not depressed; apex rounded; yellow, more or less washed with red; dots indistinct; bloom thin, bluish; skin thick, moderately tender; flesh yellow, juicy; stone medium size, oval, flattened, cling; flavour sweet, not rich, good; quality good.

A large attractive looking plum of good quality. Promising. Would be more promising if a freestone.

APPLES ORIGINATED IN THE HORTICULTURAL DIVISION.

In the last three annual reports, descriptions were published of 34 of the best varieties of apples which have been originated in the Horticultural Division, Central Experimental Farm, and 14 more are described in this report. Since the year 1897, many new seedling apples have been fruiting here. The first of these were of Russian parentage, the seed having been imported from north of Riga in Russia. Three thousand trees grown from this seed were set out in 1890 and began to fruit in 1897. Few of these proved of sufficient merit to propagate for use in Eastern Canada, but a number are being tested in the prairie provinces on account of their hardiness. In 1898, seed was saved of some of the best varieties of apples which fruited at Ottawa that year, and from this seed about 2,000 trees were raised and set out in the orchard. Of these, 523 have now fruited, 89 of which fruited for the first time in 1909. Among these are some very promising summer, autumn and winter apples. New seedlings of other sorts are being raised, which will be set out when large enough.

Some good varieties of apples have also been produced by cross-breeding in the Horticultural Division. In 1909, there were 417 cross-bred trees growing and there should be between 400 and 500 more young trees from the seed resulting from the crossing done in 1909.

In order to make the chances of obtaining desirable apples greater, quite a number of varieties have been used as parents, in most cases reciprocal crosses with the same varieties having been made, thus making many more combinations than the number of varieties might indicate. The varieties used as parents have been Anis, Anisim, Antonovka, Baxter, Bethel, Duchess, Dyer, Fameuse, Forest, Hibernal, Lawver, Lowland Raspberry, Malinda, Milwaukee, McIntosh, McMahan, Newton, Northern Spy, North Western Greening, Scott Winter, Stone, Winter Rose, Walton.

Following are descriptions, not hitherto published, of some of the most promising seedling apples originated in the Horticultural Division.

ANSON (Winter St. Lawrence seedlings).—Medium size; roundish, slightly ribbed; cavity medium depth and width; stem short, stout; basin deep, narrow, wrinkled; calyx closed; pale yellow, almost white, thinly splashed and streaked with carmine; seeds medium; dots obscure; skin moderately thick, tough; flesh white, fine grained, tender, juicy; core medium; subacid, pleasant, Fameuse-like flavour; quality good to very good; season October, probably through November.

Resembles Winter St. Lawrence a little in flavour. Distinctly of the Fameuse group. Quite promising, season coming just before McIntosh and Fameuse.

BATTLE (Wealthy seedling).—Above medium to large; roundish conic; cavity deep, medium width; stem short to medium, stout; basin medium width, medium depth, almost smooth; calyx partly open or closed; pale, greenish-yellow well splashed and washed with bright purplish-red; dots few, yellow, distinct; skin moderately thick, tough; flesh white, tinged with red, firm, crisp, breaking, tender, rather coarse, juicy; briskly subacid, aromatic, raspberry-like flavour; core medium; quality good; season late August to early September; ripens before Duchess.

Handsome in appearance. Resembles Wealthy somewhat in outward appearance and flavour. Should make an excellent cooking apple and is good for dessert.

BROCK (McIntosh seedling).—Large; roundish, slightly ribbed; cavity medium depth and width; stem short, stout; basin deep, medium width, slightly wrinkled; calyx closed; yellow, well splashed and washed with orange red; dots few, pale yellow, indistinct; skin moderately thick, tender: flesh yellowish, tender, moderately juicy; core medium, open; subacid, pleasant and vinous flavour; quality good; season mid-September to early October.

Does not resemble McIntosh except in having tender flesh. Propagate on account of large size, attractive appearance and good quality. Suggestive of Gravenstein in appearance and flavour.

Cobalt (Lawver seedling).—Medium size; roundish; cavity medium depth and width; stem long, slender; basin medium depth and width, slightly wrinkled; calyx partly open; pale yellowish-green, thinly splashed and washed nearly all over with pinkish-red; dots few, small, distinct, whitish; skin moderately thick, moderately tough; flesh firm, crisp, tender, dull white or yellowish; core medium; briskly subacid, pleasant, aromatic flavour; quality good; season mid to late winter.

Resembles Spy very much in outward appearance, flesh and flavour. Promising.

Herald (Fameuse seedling).—Medium size; roundish; cavity deep, open; stem medium length, moderately stout; basin deep, open, wrinkled; calyx closed; pale yellow, washed and splashed with crimson; predominant colour crimson; dots few, pale, indistinct; skin moderately thick, moderately tender; flesh dull white, tender, juicy; core small; subacid, good, Fameuse-like flavour; quality good to very good; season evidently November and perhaps later.

Resembles Fameuse somewhat in outward appearance and very much in flavour. Promising.

Homer (Northern Spy seedling).—Large; roundish conical; slightly ribbed; cavity deep, medium width; stem medium length, moderately stout; basin medium depth and width, wrinkled; calyx closed; pale yellow, thinly splashed and washed, mostly on sunny side, with bright carmine; seeds medium size, broad; dots few, small, pale yellow, indistinct; skin moderately thick, moderately tough; flesh dull white or yellowish, buttery, moderately juicy; core medium size, open; subacid, pleasant, Spy-like flavour; quality good; season October, probably to mid-winter.

A promising apple resembling Spy in shape, outward appearance, flesh and flavour.

Lobo (McIntosh seedling).—Above medium size; roundish conical; cavity medium depth, open, sometimes russeted; stem short to medium, stout; basin deep, narrow, almost smooth; calyx open; pale yellow, almost white, washed with bright crimson; predominant colour bright crimson; seeds medium; dots moderately numerous, grey, indistinct; bloom little, if any; skin thick, tough; flesh white with traces of red, fine grained, tender, juicy; core medium, subacid, sprightly, pleasant, not high, flavour; quality good; season October.

Resembles McIntosh considerably in outward appearance, in flesh and in flavour. Promising.

Melvin (Wealthy seedling).—Medium size; roundish; cavity deep, medium width, sometimes lipped, slightly russeted; stem medium to long, slender to moderately stout; basin medium depth and width, smooth; calyx open or partly open; pale yellow, well splashed and washed with rather dull red, but attractive; dots few, pale, distinct; skin thin, tough; flesh yellow with traces of red near skin, very tender, melting; core medium; briskly subacid, spicy, good flavour; quality good; season middle to end of August.

Considerably like Sops of Wine in outward appearance and quality, but juicier and of much better quality. Also resembles Wealthy somewhat in outward appearance and in aromatic flavour.

Nepean (Salome seedling).—Above medium to large; oblong, angular; cavity deep, medium width; stem medium length, moderately stout; basin open, medium depth, slightly wrinkled; calyx open or partly open; greenish-yellow, well washed and splashed with bright pinkish-red; dots moderately numerous, grey, indistinct; bloom thin, pink; skin moderately thick, tough; flesh yellowish, tender, buttery, moderately

juicy; core large, subacid, pleasant flavour; quality above medium to good; season mid-November probably to middle or late winter.

Resembles Salome very much in outward appearance, flesh and flavour.

Oswald (Salome seedling).—Medium to above in size; roundish conic, slightly ribbed; cavity medium depth and width; stem medium length, moderately stout; basin narrow, medium depth, wrinkled; calyx closed; pale yellow, washed and splashed with bright pinkish-red and purplish-red; dots moderately numerous, white, indistinct or merging into colour; bloom pinkish; skin moderately thick, moderately tough; flesh yellowish, crisp, tender, juicy; core large, open; subacid, pleasant flavour; quality good; season late September, October.

Resembles Salome somewhat in outward appearance. Very handsome.

Petrel (Shiawassee Beauty seedling).—Above medium size; roundish; medium depth and width; stem short to medium, stout; basin open, deep, wrinkled; calyx open; pale, greenish-yellow, splashed and washed with carmine; dots few, indistinct; skin thin, tender; flesh white, tender, breaking, juicy; core medium; subacid, pleasant flavour; quality good; season early September.

This is a good dessert apple though not very attractive in appearance. Resembles Shiawassee only somewhat in flesh. Resembles St. Lawrence in flavour. A good dessert apple.

Prosper (Wealthy seedling).—Above medium size; roundish; cavity deep, medium width, russeted at base; stem short, stout; basin deep, medium width, slightly russeted; calyx open; yellow, well washed with crimson; dots numerous, yellow, distinct; skin moderately thick, moderately tough; flesh yellowish, rather coarse, tender, moderately juicy; core medium, subacid, pleasant flavour; quality good; season December probably to late winter.

Promising, propagate. Resembles Wealthy considerably in outward appearance and in character of flesh.

Rouleau (Salome seedling).—Large, oblong, slightly ribbed; cavity medium depth, open; stem short to medium, moderately stout; basin deep, medium width, almost smooth; calyx closed or partly open; pale, greenish-yellow, splashed and washed with pinkish red; predominant colour pinkish-red; seeds medium; dots few, pale yellow, distinct; skin moderately thick, tender; flesh dull white or yellowish, crisp, tender, moderately juicy; core medium size, open; briskly subacid, pleasant, not high, flavour; quality above medium to good; season late November, probably to mid or late winter.

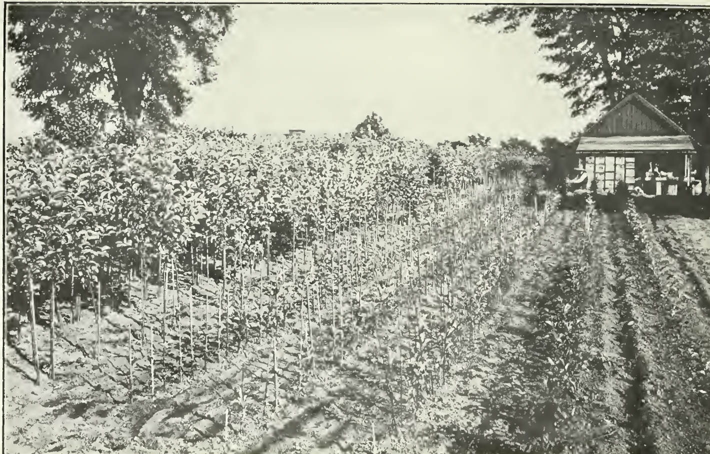
Resembles Salome considerably in outward appearance and a little in flesh and core. Promising.

Stella (Salome seedling).—Above medium size; roundish conical; cavity deep, open; stem short, stout; basin open, moderately deep, wrinkled; calyx open; pale yellow well washed on sunny side and about apex with orange, red and pinkish-red; dots few, pale yellow, indistinct; skin moderately thick, moderately tender; flesh yellowish, crisp, tender, buttery, moderately juicy; core above medium, open; subacid, pleasant flavour; quality good; season late September, October.

Resembles Salome somewhat in character of flesh and flavour and a little in colour.

A WEALTHY APPLE ORCHARD—CLOSELY PLANTED.

In the annual reports for 1902, 1904, 1905 and 1908 an account is given of a small closely-planted orchard of Wealthy apple trees, and, as the returns from this little orchard are watched with considerable interest by fruit growers, the history of it is



Nursery where new varieties of apples are propagated, Central Experimental Farm, Ottawa. *Photo by F. T. Shutt.*

continued in this report. This orchard was planted in 1896 and occupies about one-third, 40/121, of an acre. The trees were originally ten by ten feet apart, or at the rate of 435 trees per acre. A few of them have died and, in 1907, when the trees were thought to be too close in places, 7 were removed, and, in 1909, 12 were taken out. Of those removed in 1909, 8 were taken off one end of the orchard in the spring to leave room for a street car line. The original number of trees was 144; of these, 108 remain. In the spring of 1905, about one-half of the trees were headed back severely to admit more light and air; the other half were treated the same the following year. The trees are pruned moderately every year. The orchard is in sod, but, as the trees are so close, it is not thick. The grass is cut and left to lie in the orchard. As the trees are too close to take a spray pump into the orchard, a long hose is used, which is taken in from each side.

Most of the trees remaining in this orchard are healthy and vigorous and promise to give for some time returns as good as, or better than, they have in past seasons.

Following is a statement of yields, sales, expenses and profits from the time the orchard was planted to the end of 1909:—

WEALTHY ORCHARD, 1896-1909.

Net profit per acre, 1896-1904	$487 16
" " 1905	103 13
" " 1906	112 80
" " 1907	37 54
" " 1908	104 34
" " 1909	108 98
Total net profit per acre, 1896-1909	$953 95

Average net profit per acre from date of planting, 1896 to 1909	$ 68 14
Average net profit per acre from date of fruiting, 1899 to 1909	100 36

WEALTHY ORCHARD, 1908.

	Gallons.
Fruit picked	630¾
Windfalls	678½
Total	1,309¼

SALES OF FRUIT FROM CLOSELY PLANTED WEALTHY ORCHARD, 1908.

			Estimated per acre.
100 baskets	at 20c.	$20 00	$ 60 50
10 "	23c.	2 30	6 96
40 "	23¾c.	9 50	28 74
265 "	25c.	66 25	200 40
16 "	27½c.	4 40	13 31
12 "	30c.	3 60	10 89
443 baskets.		$106 05	$320 80

EXPENSES, 1908.

		Estimated per acre.
Mowing, 1 man, 10 hours at 15c. per hour	$ 1 50	$ 4 54
Spraying, 4 times	3 00	9 07
Material used for spraying, poisoned Bordeaux mixture, 7 barrels at 30c	2 10	6 35
Cost of baskets and covers at $4 per 100	17 72	53 60
Commission on sales	10 65	32 22
Rent of land	0 99	3 00
Picking fruit, 93 hours at 16⅔c. per hour	15 50	46 89
Packing fruit, 78 hours at 16⅔c. per hour	13 00	39 32
Putting on tree protectors	1 50	4 54
Manure, 4 loads at 40c., teamster with team, $4	5 60	16 94
Total expenses	$71 56	$216 47
Net profit, 1908	34 49	104 33

WEALTHY ORCHARD, 1909.

	Gallons.
Fruit picked	745½
Windfalls	748
Total	1,493½

SALES OF FRUIT FROM CLOSELY PLANTED WEALTHY ORCHARD, 1909.

				Estimated per acre.
Sold—115	baskets	at 15c	$ 17 25	$ 52 18
5	"	17½c	0 87½	2 64
139	"	20c	27 80	84 09
225	"	25c	56 25	170 15
20	"	27½c	5 50	16 66
Total 504	baskets		$107 67½	$325 72

EXPENSES, 1909.

		Estimated per acre.
Mowing, 1 man, 10 hours at 15c. per hour	$ 1 50	$ 4 54
Pruning, 1 man, 30 hours at 15c	4 50	13 61
Spraying, 4 times	3 00	9 07
Material used for spraying, poisoned Bordeaux mixture, 5 barrels at 24c	1 20	3 63
Cost of 504 baskets and covers at 4c. each	20 16	60 98
Putting on tree protectors, 1 man, 10 hours at 15c. per hour	1 50	4 54
Rent of land	0 99	3 00
Commission on sales of fruit	7 14	21 60
Picking fruit and gathering windfalls, 98 hours at 16⅔c. per hour	16 33	49 40
Packing fruit, 56 hours at 16⅔c. per hour	9 33	28 22
Packing fruit, 40 hours at 15c. per hour	6 00	18 15
Total expenses	$71 65	$216 74
Net profit, 1909	36 02½	108 98

The above yields, receipts and expenses are estimated from about one-third of an acre ($\frac{40}{121}$) although in future the area will be a little less on account of removal of one outside row of trees. The estimated figures per acre are given on the assumption that the percentage of sales would be the same from a full acre. A record is kept of the time spent in caring for this orchard. Labour is valued at 15c. per hour.

Close planting, such as is here reported upon, is not recommended for the average farmer, but, for men whose main business is fruit growing, it promises to be a more remunerative method for growing early-bearing varieties than planting them at the regular distances of thirty to thirty-six feet apart. It will probably pay better to plant trees closely in the colder than in the warmer districts. A method of close planting suggested for the best apple districts is to have the permanent trees thirty-six to forty feet apart each way, with early bearing varieties between and with additional rows of such between the permanent rows, making all the trees eighteen to twenty feet apart each way at the beginning, with the intention of cutting out the early bearing sorts in fifteen to twenty years.

Several early-bearing varieties in addition to the Wealthy are being tested at the Central Experimental Farm to see how they will succeed when planted closely.

PLUMS.

There was a medium crop of plums in 1909. The fruit was mainly from trees of the *Americana* and *Nigra* groups, most of the fruit buds of the European plums having being winter-killed, as usual. Notwithstanding spraying with Bordeaux mixture, the Shothole fungus seriously affected the foliage of many varieties of *Americana* plums, the result being that the fruit was not as large as it otherwise would have been. Considerable fruit burst this year during the ripening season as there was showery weather at that time. Trees which were heavily loaded were thinned by hand as in the previous year.

Many new varieties of *Americana* plums are being tested and seedlings are being grown here, of which some have been named and described in previous reports. The most promising new plum which fruited this year is Omaha, of which the following description was made:—

Omaha (*P. Americana x P. triflora*): Originated by Theodore Williams, Benson, Nebraska.

Tree hardy, a strong grower and productive. Fruit buds hardy. Fruit roundish, almost round; as large as largest *Americana*, $1\frac{1}{2}$ by $1\frac{1}{2}$ inches; cavity narrow, medium depth; stem short, $\frac{5}{8}$-ins., moderately stout; suture an indistinct line, little, if any, depressed; apex rounded; yellow, entirely or almost entirely covered with attractive red; dots numerous, small, distinct; bloom bluish; skin moderately thick, tough; flesh yellow, juicy, tender; stone medium size, oval, cling; flavour sweet, good except next stone and skin, where acid; quality good except next skin.

Appears to be a blend of *Americana* and Japanese. Fruit has perfume of Japanese. Foliage of tree somewhat like Japanese.

Another good new plum is Yuteca.

Yuteca (seedling of *P. Americana*): Originated by N. E. Hansen, Brookings, S.D.

Tree hardy and a strong grower. Fruit roundish, large; cavity medium width, shallow; stem long, slender; suture an indistinct line, not depressed; apex rounded; yellow, almost covered with lively crimson; dots numerous, yellow, distinct; bloom moderate, bluish; skin thick, moderately tough; flesh yellow, firm, juicy; stone medium size, roundish, semi-cling; flavour sweet, rich; quality good. *Americana* group.

An attractive looking plum of good quality. Rather promising.

CHERRIES.

The crop of cherries was an almost total failure in 1909. The fruit buds were killed by the winter. The varieties having the hardiest buds have been found to be Orel 25 and Vladimir.

GRAPES.

The crop of grapes in 1909 was a good one as far as quantity of fruit was concerned, but, although 53 varieties ripened, they were not as thoroughly ripe nor as sweet as in some years, the season being a comparatively cool one. The reason why so many varieties ripened notwithstanding the coolness was that there was no frost to cause any injury to grapes until October 20.

SMALL FRUITS.

The crops of raspberries, currants and gooseberries were good in 1909. Owing to the good covering of snow there was little winter injury except to those fruits which are always more or less injured by winter here. Among the newer bush fruits, four promising varieties are the Ruby red raspberry, the Gibraltar black raspberry, the Boskoop Giant black currant and the Perfection red currant. The strawberry crop was a medium one. Few of the newer named varieties were of special promise. The Island King, an early variety of good quality, may prove desirable. Some very fine seedlings originated at the Central Experimental Farm are being tested, and a few of these promised well in 1909.

VEGETABLES.

SWEET CORN—EARLIEST VARIETIES.

There are so many parts of Canada where the season is comparatively short that it is important for the farmer and market gardener to know which are the earliest varieties of sweet corn. Each year a number of early, medium and late sorts are tested at the Central Experimental Farm and notes are taken of the date when ready for use, the yield of marketable ears, the length of the ears, and the height to which the corn grows. These particulars are given in the following table of the six varieties found to be the earliest during the past three years:—

VEGETABLES.

SWEET CORN.—EARLIEST VARIETIES.

Variety.	Date ready for use, 1909.	Average date ready for use, 3 years 1907-9.	Yield of marketable ears from 12 hills, 1909.	Average yield of marketable ears from 12 hills, 3 years 1907-09.	Average length of ear, 3 years 1907-9.	Height 1909.		Quality.
					In	Ft.	in.	
Malakoff	Aug. 15.	Aug. 12...	68	64	5	5	4	Very good.
Early Cory..........	" 17.	" 14...	55	63	6¼	6	6	Above medium.
Peep O' Day........	" 15.	" 13...	63	59	5½	6	0	Good.
Early Foidhook.....	" 17.	" 16...	69	54	6	6	6	"
Dreer's Aristocrat...	" 17.	" 15...	50	48	6¼	6	0	"
Pocahontas	" 20.	" 15...	45	39	6½	6	4	Above medium.

The Malakoff corn is decidedly the earliest variety grown; some years the earliness is more marked than in the above table, in 1907 it being a week earlier than Early Cory. It is the best in quality of the six varieties and the most productive. Its fault lies in the shortness of the ears, but for home use this is not so important as for market. At the Experimental Farm, an endeavour is being made to improve the size of the ear by selection. The Malakoff corn is, we believe, the best to plant in the coldest parts of Canada where corn will develop.

Of the six varieties, Pocahontas has the best ears, for, while no longer than Early Cory, they are thicker. It will be noticed, however, that the yield of the Pocahontas is much less than Early Cory; nor has it proved quite so early at the Experimental Farm. The Early Cory still leads as a productive early sweet corn, although the ears of the Early Fordhook are more uniform and it is a little better in quality than Cory. While the above table shows the Early Fordhook to be a day later in the average of the past three years, an average of a longer period would show it as early as Cory. Dreer's Aristocrat is better in quality than either Early Fordhook or Early Cory, but not so productive. Peep O' Day is much like Malakoff and is a good extra early variety for home use.

Two other very early varieties which have been tested recently are the Devitt's Early and Early Iowa. These are about the same in season as Early Cory. The Devitt's Early is a little too slender in the ear for a desirable variety. Other early sorts tested and not continued are Ford's Early, Lackey's Early, Ringleader and Early Windsor.

The Golden Bantam corn, a second early sort, is of very good quality and productive and should be planted to succeed the earliest sorts. August 19 is the average date when it is ready for use.

GARDEN PEAS—BEST VARIETIES.

Every year a large number of varieties of garden peas are grown in the Horticultural Division, although, during recent years, there have not been nearly so many as formerly. Most of the varieties are grown in a single row, each 30 feet in length. Notes are taken on these each year and the new ones are compared with the old. In 1909 there were 74 varieties under test. During the past ten years some of the best have been grown in rows 100 feet in length and three feet apart, 1,200 peas of each variety being planted. The best varieties are considered to be those which do not need to be staked, are productive and are good to very good in quality. In the following table will be found seventeen of the most satisfactory sorts during the past three years, with dates when they were ready for use, the yields, the length of the vines, the length of the pods and the quality. Owing to the coolness and moisture of the early part of the summer, the vines were longer than usual; the peas were also much later than the average in being ready for use. In ordinary seasons, none of the following varieties need support except Champion of England, which is included on account of its lateness and excellent quality.

GARDEN PEAS—BEST VARIETIES.

Name of Variety.	Date ready for use, 1909.	Average date ready for use, 1907-9.	Number of pickings, 1909.	Yield of green pods in 100 feet row, 1909.	Average yield of green pods in 100 feet row, 1907-9.	Length of vine, 1909.	Length of pods.	Quality.
				Quarts.	Quarts.	In.	In.	
Early—								
Gradus	July 13	July 7.	3	44	30	30	$3\frac{1}{2}$	Very good.
Thos. Laxton	" 8	" 5.	4	32	29	42	3	Good.
Exonian	" 8.	" 3.	5	33	28	42	$2\frac{1}{2}$	"
American Wonder	" 13.	" 7.	4	32	28	30	3	Very good.
Gregory's Surprise	" 8	" 3.	5	43	27	32	$2\frac{1}{2}$	" "
Nott's Excelsior	" 9.	" 6.	5	29	24	28	3	" "
Second Early—								
Excelsior (Sutton's)	" 13.	" 8.	3	40	30	20	$3\frac{3}{4}$	Very good.
English Wonder	" 14	" 8.	3	23	29	28	$2\frac{3}{4}$	Good.
Premium Gem	" 14.	" 7.	4	25	24	41	3	Very good.
Medium—								
McLean's Advancer	" 19.	" 15.	5	42	41	42	$3\frac{1}{4}$	Very good.
Burpee's Quantity	" 17.	" 13.	3	31	40	57	$3\frac{1}{4}$	Good.
McLean's Little Gem.	" 16.	" 10.	3	25	30	48	3	Very good.
Medium late to late—								
Heroine	" 22.	" 18.	4	35	40	38	$4\frac{1}{4}$	Very good.
Market Master	" 18.	" 17.	4	52	36	32	$4\frac{1}{4}$	Good.
Stratagem	" 22.	" 20.	5	39	34	36	4	Very good.
Juno	" 24.	" 18	4	33	33	30	3	Good.
Champion of England.	" 25.	" 21.	3	24	31	77	3	Very good.

A good succession of garden peas of the best quality could be had by planting, on the same date, Gregory's Surprise, Gradus, Excelsior, McLean's Little Gem, McLean's Advancer, Heroine, Stratagem and Champion of England. This will be found more satisfactory than making successive sowings of one variety.

One of the most promising of the newer varieties is Sutton's Early Giant, it being four days later in season than Gradus, in 1909, and rather similar to the latter in growth and pod.

TOMATOES—12 EARLIEST VARIETIES, 1909.

Except in those districts where tomatoes are grown for the canning factories, earliness in tomatoes is more important than high total yield. The varieties which give the largest crop of fruit in the early part of the season when the prices are high are the varieties which will prove the most profitable. Moreover, there is a large part of Canada where the season is comparatively short, and it is very desirable when growing tomatoes for home use or market to grow the varieties which will ripen in the shortest time. Each year a considerable number of varieties are grown side by side at the Central Experimental Farm, and a record is kept of the time when they are ripe and the quantity of fruit gathered at each picking. In the following table will be found the twelve varieties which proved the earliest in 1909:—

TOMATOES.—EARLIEST VARIETIES.

Name of Variety.	Date of First Ripe Fruit, 1909.		Yield of Ripe Fruit to Aug. 9, 1909.		Estimated Yield per Acre of Ripe Fruit to Aug. 9, 1909.	Total Yield of Ripe Fruit from all pickings—five plants, 1909.		Estimated Total Yield of Ripe Fruit per Acre, 1909.	Remarks.
			Lb.	Oz.	Lb.	Lb.	Oz.	Lb.	
Sparks' Earliana, (C.E.F. strain)	July	27	7	2	3879	74	2	40361	Medium size, scarlet, almost smooth.
Jack Rose	"	26	6	7	3505	65	14	35868	Medium size, scarlet, almost smooth.
Earliest Pink	"	29	6	0	3267	58	0	31581	Medium size, purplish pink, semi-wrinkled.
Early Sunrise	Aug.	1	6	0	3267	69	4	37706	Below medium size, scarlet, smooth.
Sparks' Earliana (Johnson's No. 10 strain)	July	26	5	5	2892	63	7	34541	Medium size, scarlet, almost smooth.
June Pink	"	28	5	3	2824	66	7	36175	Medium size, purplish pink, smooth.
Nolt's Earliest	"	26	5	1	2756	77	5	42096	Medium size, scarlet, semi-wrinkled.
Sutton's A. 1	"	27	5	0	2722	58	14	32057	Medium size, scarlet, smooth.
I.X.L.	"	24	4	9	2484	45	5	24672	Medium size, scarlet, almost smooth.
Wealthy	"	28	4	0	2178	46	9	25353	Medium size, smooth, scarlet.
Sparks' Earliana, (Sunnybrook strain)	"	29	4	0	2178	76	8	41654	Medium size, scarlet, almost smooth.
Dominion Day	"	26	3	10	1973	63	6	34507	Medium size, scarlet, semi-wrinkled.

In the above table it will be noticed that there are three strains of Sparks' Earliana tomato. These are all considered as different varieties in this table, though under the same name. The Wealthy tomato resembles the Johnson's No. 10 strain of Sparks' Earliana. The Central Experimental Farm strain of Sparks' Earliana is the result of nine years' selection for earliness and six years' selection for the 'largest and most uniform crop of early fruit' from individual plants. It gave, in 1909, the largest crop of fruit up to August 9, when the prices were still high, and produced nearly the largest total crop of ripe fruit. Tested at the Horticultural Experiment Station at Jordan Harbour, Ont., in 1909, the C. E. F. strain yielded at the rate of $40 more ripe fruit per acre than five other early varieties which were tested, including three other strains of Sparks' Earliana.

For a variety to follow Sparks' Earliana, the Chalk's Early Jewel is probably the best. The Bonny Best is very much like it.

POTATOES.

The potato is one of the most important of food crops and on this account has always received marked attention at the Central Experimental Farm. Many experiments have been tried with the potato and the results have been published from time to time. At present the main experiments are the testing of varieties for comparisons of yield and earliness, spray tests, selection for immunity from Late Blight, tests to determine the value of 'change of seed,' improvement in the potato by methods advocated by the Canadian Seed Growers' Association.

The growing season of 1909 was a favourable one for potatoes and varieties of which new seed had been obtained in recent years did well. Most of the varieties under test, however, had been weakened in vitality by the dry summers of 1906, 1907 and 1908, and, although the season was favourable, some of these varieties did not yield one-fourth what they did in 1905 before the drought.

The potatoes in the uniform test plots were planted on May 19 in sandy loam soil. The crop the previous year was vegetables, the ground being well manured for them. The ground was ploughed in the spring and harrowed once with the disc harrow just before planting time. The drills were opened 30 inches apart with the double mould board plough. Sixty-six sets of each variety were planted. The sets were cut so that they would have at least three good eyes each, and were dropped one foot apart in the rows, and were covered with the hoe to ensure greater uniformity. The land was harrowed when the potatoes were coming up to destroy weeds and loosen the surface soil to conserve moisture. During the growing season the soil was cultivated seven times. At the last cultivation, a little soil was drawn towards the plants. Thus, almost level cultivation was adopted. The vines were sprayed with Bordeaux mixture four times and Paris green and arsenate of lead were used against the potato beetles.

The potatoes were dug on October 5. There was practically no scab or rot on the tubers. There were 112 varieties in the uniform test plots in 1909. Tables follow of the twelve varieties which have averaged highest in yield for the last five seasons and the thirty most productive sorts in the uniform test plots in 1909:—

TWELVE MOST PRODUCTIVE VARIETIES OF POTATOES.—AVERAGE OF FIVE YEARS.

Number.	Name of Variety.	Number of years under test without change of seed.	Season.	Colour.	Quality.	Average yield per acre, 1905-1909.	
						Bush.	lbs.
1	Dalmeny Beauty	6	Medium late	White	Good	290	50
2	Norcross	5	"	"	"	205	55
3	Carman No. 1	6	"	"	"	198	53
4	Rural Blush	21	Late	Pink and reddish	"	197	7
5	Dooley	9	Medium	White	"	194	2
6	Holborn Abundance	21	Late	"	Medium	179	31
7	Vick's Extra Early	17	Early	Pink and white	Good	176	53
8	Sabean's Elephant	15	Late	White	"	176	53
9	Morgan Seedling	7	Medium	Pink and white	"	173	22
10	Canadian Beauty	12	"	"	"	172	29
11	Ash Leaf Kidney	6	" late	White	"	170	43
12	Crine's Lightning	8	Early	Pink with red eye	"	170	17

THIRTY MOST PRODUCTIVE VARIETIES IN UNIFORM PLOTS, 1909.

Number.	Name of Variety.	Total yield per Acre.		Yield per Acre. Marketable.		Yield per Acre. Unmarketable.		Colour.
		Bush.	lbs.	Bush.	lbs.	Bush.	lbs.	
1	Sutton's Prolific	321	12	286	..	35	12	White.
2	Hard to Beat	310	12	286	..	24	12	"
3	King Edward	290	24	264	..	26	24	"
4	The Factor	266	12	246	24	19	48	"
5	New Reliance	255	12	217	48	37	24	Pink.
6	Dalmeny Beauty	244	12	222	12	22	.	White.
7	Snow	242	..	211	12	30	48	"
8	Barkley's Seedling	242	..	191	24	50	36	Pink.
9	White Giant	209	..	180	24	28	36	White.
10	King of Michigan	200	12	184	48	15	24	"
11	Uncle Gideon's Quick Lunch	198	..	162	48	35	12	Pink.
12	Early Petoskey	191	24	160	36	30	48	White.
13	The Cottar	184	48	145	12	39	36	"
14	Sutton's Sion House	182	36	140	48	41	48	"
15	Wellington	171	36	132	..	39	36	"
16	New Early Standard	162	48	132	..	30	48	"
17	Carman No. 1	158	24	140	48	17	36	"
18	Prince Albert	158	24	114	24	44	..	"
19	Planet	154	..	132	..	22	..	"
20	Norcross	151	48	127	36	24	12	"
21	Johnson's No. 2	151	48	123	12	28	36	"
22	Rural Blush	149	36	114	24	35	12	Pink and reddish.
23	Nebraska	145	12	110	..	35	12	White.
24	Gov. La Follette	143	..	90	12	52	48	"
25	Dewey	136	24	110	..	26	24	"
26	Imp. Early Ohio	129	48	92	24	37	24	Pink.
27	White Ohio	125	24	107	48	17	36	White.
28	Hick's Jubilee	125	24	94	36	30	48	"
29	Woodbury's White Rose	125	24	88	..	37	24	"
30	Canadian Red	123	12	85	58	37	24	Red.

TEN MOST PRODUCTIVE VARIETIES.—35 SETS PLANTED.

Number.	Name of Variety.	Total Yield per Acre.		Yield per Acre. Marketable.		Yield per Acre. Unmarketable	
		Bush.	lbs.	Bush.	lbs.	Bush.	lbs.
1	No. 2 from Smith Bros., Beachville, Ont	334	24	316	48	17	36
2	Seedling from W.E. Ferwell, Orillia, Ont	277	12	242	—	35	12
3	King of All	264	—	246	24	17	36
4	Eldorado	242	—	237	36	4	24
5	May Wonder	211	12	162	48	48	24
6	Sutton's Superlative	189	12	167	12	22	—
7	Sharpe's Victor	189	12	167	12	22	—
8	Howard	167	12	145	12	22	—
9	Ten Dollar	162	48	145	12	17	36
10	Talisman	162	48	140	48	22	—

TEN MOST PRODUCTIVE VARIETIES.—16 AND 8 SETS PLANTED.

Number.	Name of Variety.	Number of Sets Planted.	Total Yield per Acre.		Yield per Acre. Marketable.		Yield per Acre. Unmarketable.	
			Bush.	lbs.	Bush.	lbs.	Bush.	lbs.
1	Mayfield Blossom	16	378	24	334	24	44	—
2	Prosperity	8	316	48	299	12	17	36
3	Michigan Rose	16	290	24	272	48	17	36
4	Dewdrop	8	281	36	228	48	52	48
5	Genesse Flat	16	264	—	255	12	8	48
6	Queen of Thanet	16	264	—	237	36	26	24
7	Fidler's Invincible	16	255	12	211	12	44	—
8	Fidler's Record	16	246	24	220	—	26	24
9	Harner's Delight	16	228	48	211	12	17	36
10	White Chief	8	228	48	193	36	35	12

POTATOES—TEST OF RESISTANCE TO BLIGHT.

In 1905, an experiment was begun to learn whether varieties of potatoes could be made more resistant to the Late Blight by selection. Varieties were chosen that year which for a number of years had shown greater resistance to disease than others. The experiment is being continued. Fifteen varieties were compared in 1909. Of these, four had been selected since 1905. Of these three gave a marked increased in the selected plot in 1909:—

POTATOES.—TEST OF RESISTANCE TO BLIGHT.

Name of Variety.	Total Yield per Acre Unselected 1909.		Total Yield per Acre Selected 1909.		Yield per Acre Marketable Unselected 1909.		Yield per Acre Marketable. Selected 1909.		Yield per Acre Unmarketable Unselected 1909.		Yield per Acre Unmarketable Selected 1909.	
	Bush.	lbs.	Bush.	lbs.	Bush.	lbs.	Bush.	lbs.	Bush.	lbs.	Bush.	lbs.
State of Maine	101	12	154		74	48	132		26	24	22	
Carman No. 1	101	12	176		70	24	158	24	30	48	17	36
Holborn Abundance	127	36	127	36	105	36	105	36	22		22	
Dr. Maerker	180	24	220		132		189	12	48	24	30	48
Average	127	36	169	24	95	42	146	18	31	54	23	6
Average increase from selection	....		41	48	....		50	36				

In this test, the seed for the selected plots is obtained from the ten most productive hills from thirty-three hills planted. In another experiment, the Carman No. 1 variety is being selected from the produce of single plants each year, according to the rules of the Canadian Seed Growers' Association, but this work has not been continued long enough to report upon, although the results are very promising.

CHANGE OF SEED.

IMPORTANCE OF USING SEED OF STRONG VITALITY.

Up to the year 1906, the importance of the source of seed potatoes in Canada had not been strongly impressed upon the writer, although in the previous year, while on a visit to England, we were struck by the importance of it there. At the Experimental Farm we have been growing some varieties year after year from the same stock, grown on very similar sandy loam soil each year. Each year the best potatoes were selected for planting in the experimental plots and the results obtained seemed to justify the continuance of our own stock from year to year. Taking the results from four well-known varieties, for instance, the average yields were the following for the first four and the last four years in the sixteen years, 1890-1905, during which there was no change of seed.

Name of Variety.	1890–1893: Bushels per Acre.	1902–1905. Bushels per Acre.	Increase Bushels per Acre.
Early Rose	257	317	60
State of Maine	325	361	36
Empire State	301	338	37
Delaware	296	352	56

There was thus no indication of deterioration in the variety after sixteen years without a change of seed, but a fair increase, due, no doubt, to careful selection and good cultivation each year. But in the year 1906 there was a sudden change. That year was one of the most unfavourable seasons for potatoes that have ever been experienced at the Central Experimental Farm. During the early part of summer there was sufficient rain to keep the plants growing nicely, but just after the last cultivation, dry, hot weather set in and continued throughout the remainder of the growing season, with the result that the plants were stunted, the foliage dried up prematurely and there was a poor crop of tubers. Moreover, during the month of July there was a veritable plague of aphis which attacked the foliage and doubtless did their share in lessening the crop. The best tubers were used for seed in 1907, but the best were small and had been prematurely ripened in 1906. The early part of the summer of 1907 was dry and the tubers did not form well. The crop was again small, although most of the tubers which formed became of marketable size and were clean and well formed. The best of these tubers were used for seed in 1908, but, during that year, there was never enough moisture from the middle of June until the vines died, notwithstanding thorough cultivation. A severe attack of thrips also checked the growth of the vines. Again the best tubers were planted in 1909, and the seed used would have been considered by its appearance to be first class, as it had been kept in a cool cellar and the tubers were firm and showed little sprouting when the potatoes were planted, yet the results were very poor.

A table of the yields of the four varieties already referred to for the years 1906-1909 is interesting:—

Year.	Early Rose.	State of Maine.	Empire State.	Delaware.
	Yield Per acre.	Yield Per acre.	Yield Per acre.	Yield Per acre.
	Bush.	Bush.	Bush.	Bush.
1906	150	132	132	103
1907	128	174	117	114
1908	69	97	117	156
1909	18	62	62	53
Average 1906-09	91	116	132	131
Average, 1902-1906, before the drought	317	361	338	352

It will be seen from the above figures that there has been a marked falling off in yield during the past four years, part of which in the years 1907 and 1908 was doubtless due to the weakened vitality of the seed and part to the very unfavourable seasons. In 1909, with a more favourable season and good cultivation, the small yield is evidently owing largely to seed low in vitality, although, in 1909, there was considerable injury from disease which caused the rotting of the stem. Newer seed of other varieties yielded in these bad years as high as at the rate of 224 bushels per acre in 1906, 462 bushels per acre in 1907, 325 bushels per acre in 1908 and 321 bushels per acre in 1909, showing that, notwithstanding unfavourable conditions, seed of strong vitality gave good results.

As the crop of potatoes had been so poor in 1906, and as the prospects for a good crop in 1907 from seed of the previous year's crop were not thought favourable, it was considered desirable to compare the results with imported seed. Accordingly, small quantities of tubers of six well-known varieties of potatoes were procured from the Experimental Farm, Nappan, N.S. As the best of the home-grown seed had been used in other experiments before this imported seed was planted, the results obtained that year are not considered reliable, but it may be said that the average yield from the imported varieties was almost twice as great as from the home-grown seed of the same sorts. In 1908, it was possible to make a fairer comparison, and the best seed from the imported stock of the year before was compared with the best seed of the home-grown stock. The results were published in the annual report for 1908, and showed an average increase from the six varieties of 133 bushels per acre in favour of the Nappan seed.

This test was continued in 1909, new seed of some of the same varieties being obtained from Nappan again this year and compared with the Nappan stock of 1907 grown two years at Ottawa and with our old stock. The results are as follows:—

—	Rochester Rose.		Carman No. 1.		Vick's Extra Early.	
	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.
Nappan seed, 1909	215	36	198	0	171	36
Nappan seed, 1907	127	36	52	48	198	0
C. E. F. seed	44	0	83	36	74	48

It will be seen from this table that, in every case, the Nappan seed of 1909 yielded much more than the Experimental Farm seed—nearly five times as much in one case and more than twice as much in two cases. In two cases the Nappan seed of 1907 yielded much better than the Farm seed of the old stock, although in one case the Farm seed did a little better.

These results show that a change of seed sometimes more than doubles the yield of potatoes. How, then, shall we decide when it is desirable, to have a change of seed and what are the conditions which give seed strong vitality?

If we know when to change our seed and where to get it from, there is no doubt but that potato growing would be much more profitable.

In the first place, every potato grower should be an experimenter. He should try on a small scale the varieties which other experimenters have found most productive. If he discovers a variety which is better than his own, he should not only grow more of that variety, but when he is getting the seed he should, if possible, get it from the same source as he obtained his trial lot from, for if he obtained it from another source it might not do as well as his own.

If a grower has been getting but fair or poor crops from the variety he is growing, he should try a change of seed, even if getting the same variety. Moreover, when he has found that it pays him to obtain seed of a certain variety from a certain source, he should endeavour by experiment and calculation to learn whether it will pay him to change his seed every year, every two years or every three years.

It has been fairly well shown, we think, that potatoes which are prematurely ripened, either by an early drying-up of the tops or by poor development on a weak vine, are low in vitality and should not be used as seed if the best results are desired. In Great Britain it is now well recognized from the results of careful experiments that seed potatoes from the south of England, where the climate is comparatively dry and warm, and where potatoes ripen much more rapidly than they do in Scotland and Ireland, do not give nearly as large yields as seed potatoes from Scotland and Ireland. In an experiment which I had the opportunity of seeing at Sutton & Sons, Reading, England, in 1905, where Scotch and English seed of the same varieties had been planted side by side, the English stock was evidently three weeks nearer maturity than the Scotch stocks.

In an experiment conducted in England by the Department of Agriculture of Ireland to determine the relative value of Irish and English seed potatoes there was a marked difference in favour of the Irish seed.

It is now fairly well proven that the cause of the seed potatoes being better from Scotland and Ireland than from some parts of England is that the tubers in the former countries are not hurried to maturity by hot, dry weather, and on this account have more vitality or power to make strong growth when planted than where the summers are comparatively hot and dry. Coming nearer home, the conditions in the drier and warmer parts of Ontario may be compared with England, while the conditions in the moister and cooler parts of Ontario and the maritime provinces may be compared with Scotland and Ireland. It is possible that as marked results could be obtained from a change of seed from the cooler parts of Quebec and Northern Ontario as from Nappan, Nova Scotia. It may even be that seed potatoes from a cool, moist clay loam soil near home might show some striking results.

There is a difference between immature tubers and prematurely ripened tubers. Potatoes grown in cool climates tend to be immature. Potatoes grown in warmer climates tend to be prematurely ripened. Immature potatoes may be growing vigorously and the tops be cut off by the frost, or they may be dug before the tops are dead and before they are perfectly ripe. The tubers are checked in growth but are full of vitality. It is interesting to note that immature potatoes have been recommended for seed potatoes in England for at least one hundred years.

The Department of Agriculture for Ireland makes this recommendation:—

'Immature seed.—It is now recognized that seed from crops lifted before they are fully mature will produce more vigorous plants, and, consequently, heavier yields than seed from crops which have been allowed to become fully ripe. In Ireland this applies more particularly, perhaps, to early varieties, but it is a point worthy of notice by growers of seed potatoes.'

At the Central Experimental Farm the seed from tubers grown from potatoes planted on June 23, and even on July 7, 1899, yielded, in 1900, more than those from potatoes planted May 22, 1899. The late planted ones were not so mature or were immature when dug.

SPRAYING.

For the past nineteen years experiments in spraying have been conducted by the Horticultural Division every season, and useful information has been obtained as to the value of different spraying materials for the prevention of fungous diseases and insect pests. Much work has been done by experimenters during the past few years with the lime-sulphur washes, especially in those districts where the San José scale is troublesome, but at Ottawa, where there is no San José scale, the experiments have been mainly in other directions. The lime-sulphur wash has been found to be the best spray so far known for winter use to control this scale insect, and it is now being used in a more dilute condition as a summer spray as well, but so far it has not been shown what strength may be safely used in all parts of Canada. Just as a certain strength of Bordeaux mixture causes russeting of apples in some parts of Canada while in others it does not, so will a certain strength of lime-sulphur cause injury in one place while in another it will not. Much seems to depend on the relative wetness or dryness of the season, or the relative moistness or dryness of the air. In Nova Scotia, for instance, where the air is moister than it is in some parts of Ontario and Quebec injury from spraying materials is more likely to occur than in the latter provinces, the leaves, on account of the moistness, being less able to resist the fungicides or insecticides; hence a formula for a summer spray is not always the best for all parts of the Dominion. When it is desired to make the lime-sulphur wash at home for winter use, a good formula is 20 lbs. of lime, 15 lbs. of sulphur and 40 gallons of water, boiled for an hour. Some of the larger growers now prefer to make the mixture in a more concentrated condition. The proportions found best for the concentrated mixture by Prof. Stewart, of the Pennsylvania Experiment Station, who has made a special study of the subject and who uses a larger proportion of sulphur, are 100 lbs. lime, 200 lbs. sulphur, 80 gallons of water (100 gallons wine measure). When boiled down there should be about 80 imperial gallons of the concentrated material, sufficient water being added to make this amount. The degree to which this will be diluted after it is made will depend on its density. There are a a number of commercial concentrated lime-sulphur washes now on the market, and as the best of these have given about as good results, on the whole, as material made at home, they are fast becoming the more popular. A dilution recommended for winter use is 1 gallon of the concentrated wash in 9 gallons of water, but the density of the commercial washes varies as does that of the home-made washes, hence it is well to use a hydrometer to determine the density and base the dilution on that. For summer use, lime-sulphur in the proportion of 1 gallon of the concentrated wash in 29 gallons of water has been successfully used, but, as stated before, this strength may cause injury in some parts of the country and in some seasons, and further trials are necessary to determine the most effective strength which can be used at the least risk. Arsenate of lead has so far been found to be the best poison to use with the lime-sulphur wash.

At Ottawa. Bordeaux mixture continues to give very satisfactory results in the control of apple spot and where russeting does not occur is to be preferred to the lime-sulphur mixture for the prevention of this disease. Arsenate of lead with

Bordeaux has given excellent results in the control of Codling Moth, although Paris green has been found quite effective also.

Experiments in 1909.

LIME-SULPHUR FOR APHIS EGGS.

An experiment was conducted in the spring of 1909 to determine what effect the lime-sulphur wash had on the eggs of the Apple Aphis. Three rows of young nursery trees, each 85 feet long and badly infested with eggs, were sprayed on May 8 with the Niagara brand of lime-sulphur diluted in the proportion of 1 gallon to 11 gallons water. Other rows were left unsprayed for comparison. As far as could be determined, the lime-sulphur did not destroy any of the eggs; the insects appeared to be as abundant after they were hatched on the sprayed as on the unsprayed trees.

LIME-SULPHUR FOR GOOSEBERRY MILDEW.

Both in 1908 and 1909 the Niagara brand lime-sulphur has been used in the proportion of 1 part of the wash to 11 parts of water for the control of gooseberry mildew, but only one spraying has been given each year, namely, when the buds were breaking. The spray was applied in 1909 on May 8 to twenty-six varieties of gooseberries, one bush of each of these varieties being left unsprayed. Notes were taken on July 28 and in no case was there a noticeable difference in the amount of mildew in favour of the sprayed bushes. Similar results were obtained in 1908. It is possible that, with the addition of several summer sprays, the disease may be controlled with the lime-sulphur wash and it is hoped to continue experiments in this direction.

INSECTICIDES TO CONTROL APPLE APHIS.

The apple aphis has been very troublesome some years in the orchards at the Central Experimental Farm and was especially so during the past two years. Experiments have been tried with a number of insecticides for the control of aphis, and the results have been published from time to time in the annual reports, the last result appearing in the report for the year ending March 31, 1909. In the summer of 1909, some of the insecticides tried the previous year were used again for comparison with others, and the results are given below. The cost of the material makes some of the insecticides decidedly the most economical to use. In this respect, the whale oil soap is much the best when large quantities are required, as it was obtained by the barrel in 1909 for 3 cents a pound.

Spraying large trees for aphis is, at the best, an unsatisfactory business; one spraying is not sufficient. The insects multiply so rapidly, and it is so difficult to hit them, that it is necessary to give a second and even a third spray at intervals of a week or less to keep the insects under control, and sometimes this is not practicable.

One row each of apple trees in nursery rows, each 90 feet long, was sprayed with each of the insecticides given in the following table. The trees were sprayed on July 14 and July 20. Notes were taken of the results on July 15 and July 22, 1909. The trees in all the rows were badly infested with aphis before spraying.

Nursery Stock—Apple Trees.

SPRAYED WITH INSECTICIDES FOR THE CONTROL OF APHIS, 1909.

Plot 1.—Campbell's Nico Soap, 1 lb. to 40 gallons water:—

First spraying, how infested July 15, after spraying: a large proportion killed, but many still left, of which a considerable number are on trunk. Second spraying, July 20; after spraying, July 22; aphis nearly all dead, a very few left on some upper leaves. Cost per barrel of 40 gallons, 50c.

Plot 2—V-2 Fluid, 3½ pints to 40 gallons water.

First spraying, July 15; after spraying: a fairly large proportion killed, but many left; more than in Plot 1. Second spraying, July 20; after spraying, July 22;

a few aphis on trunk and considerable number on upper leaves. Cost per barrel of 40 gallons, $1.

Plot 3—McDougall's Insecticide, 3½ pints to 40 gallons of water:—

First spraying, July 15; after spraying: more killed than in either Plot 1 or Plot 2. Second spraying, July 20; after spraying, July 22; practically all dead on trunk; a considerable number left on upper leaves. Cost per barrel of 40 gallons, 72c.

Plot 4—Whale oil soap, 7 lbs. to 40 gallons of water:—

First spraying, July 15; after spraying: a large proportion killed, but few still left on trunk and many on under side of leaves; if anything, a little more effective than sprays 1 and 2. Second spraying, July 20; after spraying, July 22; practically all dead on trunk; a considerable number left on upper leaves. Cost per barrel of 40 gallons, 23½c.

Plot 5—Kerosene emulsion, 4½ gallons oil, 5 lbs. flour, 36 gallons water:—

First spraying, July 15; after spraying: a large proportion killed, but a few still left on trunk and many on under side of leaves. About like Plots 1 and 2. Second spraying, July 20; after spraying, July 22; practically all dead on trunk, a few left on upper leaves. Cost per barrel of 40 gallons, 72c.

Plot 6—Kerosene emulsion, 3 gallons of oil, 12 ounces of Takanap soap, 40 gallons of water:—

First spraying, July 15; after spraying: a large proportion killed, but a few still left on trunk and many on under side of leaves; about like Plots 1 and 2. Second spraying, July 20; after spraying, July 22: a few aphis on trunk, a considerable number on upper leaves, much as Plots 2, 3 and 4. Cost per barrel of 40 gallons, 47½c.

INSECTICIDES TRIED FOR CONTROLLING THE COLORADO POTATO BEETLE.

Every year the farmer and horticulturist who grows potatoes has to fight and conquer the Colorado Potato Beetle if he is to obtain a good crop of potatoes. Paris green has been the insecticide most generally used for the past twenty-five or thirty years, and most effectually will it destroy the young beetles as long as it remains on the foliage. The young beetles eat so rapidly, however, and there are usually so many of them, that unless the poison is well distributed over the leaves, many of the latter will be eaten before the larvæ are killed. For this reason, much more Paris green is often used per barrel of water than is necessary if it were put on with a fine spray and covered the leaves well. Farmers will use as much as two pounds of Paris green to 40 gallons of water, whereas half a pound to that quantity of water has given excellent results at the Experimental Farm in fine weather. Some times the weather is showery, and, at such times, larger quantities are necessary in order that the bugs may be destroyed quickly. Of late years, arsenate of lead has been taking the place of Paris green as an insecticide for fruit trees and is now being used more extensively for potatoes. Arsenate of lead does not injure the foilage as does Paris green at times, and, on account of the particles being more finely divided, it stays in suspension longer and adheres better. It does not kill quite so rapidly as Paris green, but it is surer to kill in showery weather because it stays on the leaves when much of the Paris green is washed off. A larger quantity of it has to be used per barrel than Paris green, but as it is about half the cost of the latter, the expense is almost the same.

The following experiments were tried mainly for the purpose of comparing Paris green with arsenate of lead and to show what quantity of arsenate of lead was the most economical to use. Paris green and arsenate of lead were also tried mixed, in order to have the quick action of the Paris green and the adhesiveness of the arsenate of lead in the same mixture. Arsenite of lime and arsenite of soda were also used. These insecticides were sprayed on rows, each fifty feet in length, in some cases several rows being sprayed with one insecticide. In the second experiment the rows were sixty-six feet in length.

Philadelphus Lemoinei Bouquet Blanc.

TEST OF INSECTICIDES FOR CONTROLLING THE COLORADO POTATO BEETLE.

Number of Plot.	Experiment No. 1. — Insecticide Used.	1st Spray. Number of young beetles.—July 9. Before spraying.	1st Spray. Number of young beetles. — July 12.	Extra Spray for some plots. Number of young beetles.—July 13. Before spraying.	1st Spray and extra spray. Number of young beetles. — July 16.	2nd Spray. Number of young beetles.—July 24. Before spraying.	2nd Spray. Number of young beetles. — July 26.
1	8 ozs. Paris green to 40 gals. water	Few	Fairly numerous	Fairly numerous	Few	Fairly numerous	Very few.
2	3 lbs. Arsenate of Lead (Vreeland) to 40 gals. water	"	None		"	Few	"
3	8 ozs. Paris green and 1½ lbs. Arsenate of Lead (Vreeland) to 40 gals. water	"	"		"	Numerous	"
4	8 ozs. Paris green and 3 lbs. Arsenate of Lead (Vreeland) to 40 gals. water	"	"		"	Few	None.
5	1 lb. Paris green to 40 gals. water	Fairly numerous	"		"	Fairly numerous	"
6	2 lbs. Arsenate of Lead (Vreeland) to 40 gals. water	"	"		"	"	"
7	Arsenite of Lime (Arsenite of Soda, Solution 1 pint) Lime 2 lbs., water 40 gallons	"	Few	Few	"	Numerous	Few.
8	Arsenite of Lime (Arsenite of Soda, Solution 1 quart) Lime 2 lbs., water 40 gallons	"	Very few	Very few	Very few	Fairly numerous	"
9	Arsenite of Lime (White Arsenic, 2 ozs., Lime 2 lbs., water 40 gallons)	Numerous	Fairly numerous	Fairly numerous	Few	Numerous	"
10	Arsenite of Lime (White Arsenic 4 ozs., Lime 2 lbs., water 40 gallons)	"	"	"	None	Few	None.
	Check Plots.						
11	8 ozs. Paris green to 40 gals. water	"	"	"	Very few	Fairly numerous	Very few.
12	3 lbs. Arsenate of Lead (Vreeland) to 40 gals. water	Fairly numerous	None		None	Very few	None.
13	8 ozs. Paris green and 1½ lbs. Arsenate of Lead (Vreeland) to 40 gallons water	"	"		"	"	"
14	8 ozs. Paris green and 3 lbs. Arsenate of Lead (Vreeland) to 40 gals. water	Few	"		"	"	"
15	1 lb. Paris green to 40 gals. water	Fairly numerous	"		Very few	Fairly numerous	"
16	2 lbs. Arsenate of Lead (Vreeland) to 40 gals. water	Few	"		Few	"	"

Number of Plot.	Experiment No. 2. — Insecticide Used.	Number of Young Beetles. — Aug. 12 Before Spraying.	Number of Young Beetles. — Aug. 14.	Number of Young Beetles. — Aug. 25.
1	1 lb. Arsenate of Lead (Vanco) to 40 gall. water	Fairly numerous..	Few...........	Fairly numerous.
2	1½ do do do ..	Fairly numerous..	Few.	Fairly numerous.
3	2 do do do ..	Fairly numerous..	Few.............	Few.
4	2½ do do do ..	Fairly numerous..	Few.............	Very few.
5	3 do do do ..	Fairly numerous..	None...........	None.
6	8 ozs. Paris green to 40 gallons water......	Fairly numerous..	Few	Fairly numerous.
7	1 lb. do do do ..	Fairly numerous..	None............	Very few.
8	Arsenite of Lime (Arsenite of Soda Solution 1 pint Bordeaux mixture 40 gallons).. ...	Fairly numerous..	Fairly numerous...	Fairly numerous.
9	Arsenite of Lime (Arsenite of Soda Solution 1 quart Bordeaux mixture 40 gallons)......	Fairly numerous..	Few..............	Fairly numerous.
10	Arsenite of Lime (2 ozs. White Arsenic to 40 gallons Bordeaux mixture).........	Fairly numerous..	Few..............	Fairly numerous.
11	Arsenite of Lime (4 ozs. White Arsenic to 40 gallons Bordeaux mixture).....	Fairly numerous..	Few.........	Fairly numerous.
12	Arsenite of Lime (4 ozs. White Arsenic, Lime 2lbs., to 40 gallons water	Fairly numerous..	None....	Fairly numerous

In the first experiment it was found necessary to make three applications of the spraying material on Plots 1, 7, 8, 9, 10, 11, while two were sufficient for the others. It will be seen that 8 ounces of Paris green to 40 gallons of water did not prove so effective as 1 lb. of Paris green to 40 gallons of water, the latter quantity giving quite satisfactory results. It may be observed here that, in other years, 8 ozs. of Paris green to 40 gallons of Bordeaux mixture, and even to 40 gallons of water, has given satisfactory results when the weather remained fine for some time after spraying. Three pounds of arsenate of lead to 40 gallons was more effective than 1 lb. of Paris green; and 2 lbs. arsenate of lead to 40 gallons water was as effective as 1 lb. of Paris green. The formula of 8 ozs. Paris green, 1½ lbs. arsenate of lead to 40 gallons water gave as good results as any. The arsenite of lime formulas were effective, particularly those used on Plots 8 and 10, but three applications were necessary in order to control the larvæ.

In the second experiment, where a different brand of arsenate of lead was used and other formulas tried, it was found that 2 lbs. of arsenate of lead to 40 gallons of water was quite effective, though slightly better results were obtained with larger quantities. It will be seen that the results from the arsenite of lime formulas were not as satisfactory as those where 1 lb. Paris green or 2 lbs. or more of arsenate of lead were used.

From the experiments tried in 1909, it would appear that the best formulas are arsenate of lead, 2 to 3 lbs. to 40 gallons of water; Paris green, 1 lb. to 40 gallons water; and Paris green 8 ounces, arsenate of lead 1½ lbs. to 40 gallons water. It is thought that Paris green and arsenate of lead applied together will give better results on the whole than the two applied separately. The Paris green appears to kill quicker than the arsenate of lead, but the latter is much more adhesive. To get the best results, both Paris green and arsenate of lead should be made into a thin paste by adding a little water to the poisons and stirring before diluting to the formula recommended. The formulas found best when used without Bordeaux mixture might need altering in the direction of using less poison, as has been found to be the case with Paris green.

Arsenate of lead costs a little more than half as much as Paris green, and white arsenic is about half the cost of Paris green per pound.

ARBORETUM AND BOTANIC GARDEN.

The collection of trees, shrubs and herbaceous plants in the Arboretum and Botanic Garden is now one of the largest in America. It has been brought to its present size by a gradual but regular increase in the collection from year to year. By being constantly on the look out for new things from other institutions, nurserymen and private individuals it has been possible to add a considerable number of species and varieties every year. Many species are grown from seed and later are transplanted from the nursery to their permanent positions. The number of species and varieties of trees and shrubs added in 1909 was 129, making a total of 3,204 species and varieties, represented by 4,929 specimens living in the Arboretum in the autumn of 1909. The number of species and varieties of herbaceous perennials added in 1909 was 178. The total number living in the autumn of 1909 was 2,044. There was an average amount of injury to trees, shrubs and herbaceous plants from the winter of 1908-09. The summer of 1909 was a favourable one for growth and most of the plants did well.

From time to time lists have been published of the best trees, shrubs and herbaceous plants, which have been found very useful by those who desire to improve their grounds.

Following is a list of the best *Philadelphus* tested in the Arboretum, with notes upon them:—

THE BEST PHILADELPHUS.

The genus *Philadelphus,* to which the names Mock Orange and Syringa are commonly applied, has among its species and varieties some of the most desirable hardy ornamental shrubs. Blooming after the bush honeysuckles, lilacs, early spiræas and viburnums are over, these shrubs do much to enliven the landscape by their charming, white flowers, which are borne in great profusion. The lower-growing varieties, which are found chiefly among the Lemoine hybrids, are especially valuable where deutzias are tender. A good collection of philadelphus will furnish bloom from four to five weeks, the earliest varieties blooming in early June at Ottawa, while the latest are not out of bloom until near the middle of July and sometimes not until after the middle of that month.

In the Arboretum and Botanic Garden at the Central Experimental Farm, there are 61 species and varieties of *Philadelphus.* Some of these are, however so much alike that for ornamental purposes they may be considered the same. The nomenclature of the *Philadelphus* is so confusing owing to hybridization that, in the following list of the best species and varieties tested at Ottawa, their trade names are used:

Philadelphus Schrenkii (Mandschuria).—Height, 5 feet; flowers medium size, white, from 4 to 5 on each raceme; very sweet scented. A free bloomer and desirable on account of its extreme earliness—being about a week earlier than *P. coronarius.* Not specially showy.

Philadelphus coronarius (Southeastern Europe; Caucasus).—Height, 8 to 10 feet; flowers medium size, creamy-white, from 5 to 6 on each raceme, very sweet scented. A free bloomer. The typical Mock Orange, and popular because of its being sweet scented. Season early. A variety, *P. coronarius semi-plenus,* is better than the type. It has 6 to 9 flowers to the raceme and some of the flowers have a few extra petals.

Philadelphus grandiflorus laxus.—Height 10 feet; flowers large to very large, averaging 2 inches in diameter, pure white in loose racemes of from 3 to 6 flowers;

sweet scented. Season early. A free bloomer and evidently of hybrid origin. The best early variety at the Experimental Farm.

Philadelphus speciosissimus.—Height, 9 feet; flowers above medium size, averaging 1½ inches in diameter, creamy-white, in racemes of 3 to 5 flowers; sweet scented. A very free bloomer; season early. Begins to bloom about 2 days after *P. grandiflorus laxus.*

Philadelphus Lemoinei.—Under the specific name of Philadelphus Lemoinei a great many attractive varieties have been sent out by the firm of V. Lemoine & Son, Nancy, France. Most of those which have been introduced are hybrids between *P. microphyllus* and *P. coronarius.* The former variety is not altogether hardy at Ottawa and some of the hybrids have proven too tender also, among these being Avalanche, Boule d'Argent, Candelabre, Gerbe de Neige and Pavillon Blanc, but the following varieties have done well:—

Philadelphus Lemoinei Boquet Blanc.—Height, 6 feet; flowers below medium size, 1 to 1¼ inches in diameter, creamy-white, sometimes with additional petals, sweet scented, in compact racemes, averaging 7 to 8 flowers, but often 15 to 20 flowers, so arranged that they almost touch one another, giving the bush the appearance of being almost covered with bloom; season medium. The best low growing variety and appears hardier than most of the Lemoine hybrids. Older specimens may grow taller.

Philadelphus Lemoinei Nuee Blanche.—Height, 5 feet; flowers large, 1¾ inches in diameter, pure white, slightly scented, in racemes of 3 to 5 flowers, mostly 3; season medium. *P. Lemoinei Rosace* is somewhat similar, but some flowers are semi-double. Older specimens may grow taller.

Philadelphus Lemoinei Mont Blanc.—Height, 4 feet; flowers small, ⅞ to 1 inch in diameter, white, sweet scented, in slender racemes of 5 flowers; midseason; very free bloomer. Valuable because so low growing.

Philadelphus Lemoinei Manteau d'Hermine.—Height, 3 feet; flowers small creamy-white, semi-double, sweet scented, in racemes of 5 to 8 flowers; midseason. A very free bloomer and valuable because so low growing.

Philadelphus grandiflorus major.—Height, 7½ feet, but will probably grow taller; flowers very large, 2 to 2¼ inches in diameter, pure white, almost scentless, in racemes of 3 to 5 flowers, mostly 3; midseason. A very distinct and attractive variety.

Philadelphus 144 Voronesh.—Brought from Russia by the late Prof. J. L. Budd. Height, 10 feet; flowers very large, averaging 2 inches in diameter, pure white, almost scentless, in racemes of 3 to 5 flowers; season medium late. Very free bloomer. The best of its season.

Philadelphus grandiflorus (Virginia to Florida).—Height, 14 feet; flowers large, 1⅝ inches in diameter, white, sweet scented, in racemes of 8 to 11 flowers; season late. A free bloomer. Others which resemble this very much are *P. latifolius, P. latifolius sanguineus* and *P. latifolius verrucosus,* and *P. pubescens.* While there are others of the same season of more graceful habit, this is valuable because of its great height.

Philadelphus Gordonianus gracilis.—Height, 10 feet; flowers large, 1½ to 1¾ inches in diameter, white, sweet scented, in racemes of 5 to 7 flowers; season late. A free bloomer and of graceful habit. A very good variety.

Philadelphus inodorus speciosus grandiflorus.—Height, 9 feet; flowers medium size, 1⅜ to 1½ inches in diameter, white, almost scentless, in close racemes of 5 to 7

flowers; season late. A free bloomer, graceful, and with rather small foliage. One of the best of its season.

Philadelphus columbianus floribundus.—Height, 6 feet; flowers medium size, $1\frac{1}{4}$ to $1\frac{3}{8}$ inches in diameter, white, sweet scented, in long racemes of 9 to 10 flowers, usually in pairs; season late. A very free bloomer.

Philadelphus Gordonianus monstrosus.—Height, 8 feet; flowers medium size, $1\frac{3}{8}$ to $1\frac{1}{2}$ inches in diameter, creamy-white, sweet scented, in racemes of 7 to 8 flowers; season late. A very free bloomer.

Philadelphus coronarius myrtifolius.—Height, 9 feet; flowers medium size, $1\frac{3}{8}$ to $1\frac{1}{2}$ inches in diameter, pure white, sweet scented, in compact racemes of 7 to 9 flowers; season late. A free bloomer and a graceful and distinct variety.

Philadelphus Billardii (P. pubescens Souvenir de Billard)—Height, 8 feet; flowers above medium size, $1\frac{1}{2}$ inches, pure white, almost scentless, in racemes of 15 to 20 flowers, the latter usually in threes; season very late. Very desirable on account of lateness and attractive appearance. Is injured by winter in some years.

REPORT OF THE CEREALIST.

CHARLES E. SAUNDERS, B.A., PH.D.

OTTAWA, March 31, 1910.

DR. WM. SAUNDERS, C.M.G.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith the seventh annual report of the Cereal Division.

The season of 1909 was not so unfavourable for cereals at Ottawa as might have been expected from the unusually cool and wet weather in spring. A very favourable summer brought the crops up to a fair average in many instances.

The propagation of some of the new, selected, cross-bred varieties of cereals which have originated from the cross-fertilizing done in the year 1903 (just after the establishment of this Division as a separate branch of the work) has now progressed so far that a large series of small plots was sown last spring, many of which yielded several pounds of seed. About fifty of the new sorts of wheat from these small plots were submitted to milling and baking tests during this winter, with most interesting results, some of them surpassing Red Fife wheat in their ability to produce light bread.

The regular milling and baking researches conducted in this Division included also such problems as the effect of storage on wheat and flour, damp wheat, bleached flour, &c., besides the testing of new varieties and of older sorts grown in various sections of the Dominion.

Mr. Geo. J. Fixter, the foreman of the field work of this Division, has carried on his work in his usual faithful and competent manner. I am indebted to him for keeping the records of all the regular test plots as well as for valuable assistance in other ways.

In the following pages there are presented some of the most interesting results of the work done between April 1, 1909, and March 31, 1910.

I have the honour to be, sir,

Your obedient servant,

CHARLES E. SAUNDERS,

Cerealist.

MEETINGS ATTENDED.

The most important meetings attended during the year were those of the British Association for the Advancement of Science, held at Winnipeg towards the end of August.

At a joint session of the sections dealing with Agriculture and Chemistry, many papers on wheat were presented, including one by the writer on 'Wheat Breeding in Canada.' As this paper is being published in England in a somewhat inaccurate and condensed form, it has been thought best to print it here in full.

"WHEAT BREEDING IN CANADA."*

On account of the vast extent and the varied climatic conditions of Canada, it seems necessary at the beginning of this paper (in order that we may intelligently consider our subject) to mention briefly the chief sections into which the country may be divided on the basis of its wheat production. Viewed in a broad way, we may recognize six distinct wheat-growing areas.

I. The Maritime Provinces: Nova Scotia, Prince Edward Island and New Brunswick.—In these large tracts of country not very much wheat is grown. Most of the grain is sown in the spring and the yields obtained are usually good, the kernels being plump, but rather soft and starchy.

II. Quebec and Northern Ontario.—In this large area, spring wheat, rather than winter wheat, is usually grown, although the total quantity produced is not very great considering the numerical strength of the farming population. The kernels of the spring wheat produced in this section of Canada are usually somewhat smaller and harder than those grown in the maritime provinces. When the varieties which yield the strongest flour are sown, the wheat from this area is scarcely surpassed in flour strength by that grown in any other part of Canada, though in appearance it is usually less attractive than the grain from the western prairies.

III. Southern Ontario.—The mild winter and the rather hot and dry summer make the conditions in this region more favourable to winter wheat than to spring wheat. Most of the sowing is, therefore, done in the autumn, September and October being the favourite months. The winter wheat of Southern Ontario is typically large, plump and quite starchy. When spring wheat is sown, a variety of durum wheat known in Canada as 'Goose' or 'Wild Goose' is often used because it gives a better yield than the ordinary varieties used for bread making. Goose wheat is used chiefly for feeding purposes or for the manufacture of macaroni.

IV. Manitoba, Saskatchewan and the northern and central parts of Alberta.—This enormous tract of country is devoted very largely to the cultivation of spring wheat which, as a rule, gives a good yield and produces kernels of a hard, glutinous character scarcely to be surpassed. Winter wheat has been tried in some sections, but has not proved uniformly successful.

V. Southern Alberta.—Winter wheat has been profitably grown for many years in the southwestern portion of Alberta and the cultivation of this crop has been largely increased of late, the area devoted to it being extended northwards and eastwards. Spring wheat is also grown in this portion of the province, but to a smaller extent than winter wheat. The yield per acre of winter wheat is usually large and the kernels are exceptionally heavy and hard.

* Read before the British Association for the Advancement of Science, at Winnipeg August, 1909.

Experimental Plots, Central Experimental Farm, Ottawa. Peas and small plots of cereals in the foreground. Sixtieth acre plots of wheat in the distance.
Photograph taken in the month of May, 1910, by C. E. Saunders.

16—p 160

VI. British Columbia.—This province does not produce very much wheat though it is grown in some localities and found profitable. Both winter and spring varieties are sown. The diversity of climates in this province is so great as to render impossible any general descriptive remarks on the subject.

From the details just given it will be readily seen that winter wheat occupies in Canada a distinctly subordinate place to that of spring wheat. In order, therefore, to bring my subject within reasonable limits, I shall take the liberty of omitting all discussion of the work which has been done in this country in regard to winter wheat. In regard to spring wheat almost all the systematic and careful work which has been done in Canada has been carried on at the Dominion Experimental Farms during the past twenty-two years, and it is in regard to this work that I shall address you.

Most of the breeding and selecting of varieties of wheat in connection with the Dominion Experimental Farm system has been performed at the Central Farm at Ottawa where the climate resembles, in many respects, that of most of the spring wheat districts of Canada. It might appear, on first thought, as if better results would have been obtained by conducting the work independently at each of the Experimental Farms, but not only would this plan have involved an expenditure of money several times in excess of that required under the existing arrangement, but it would have introduced greater risks as well; for it must be remembered that when such operations are carried on under trying conditions of climate, any season of exceptional severity might seriously cripple the work just when results of value were being looked for. The present arrangement under which the cross-breeding and the fixing of types are carried on at Ottawa is therefore clearly the most desirable. Of course, the selections made at the Ottawa Farm are only provisional, the most promising varieties being afterwards sent to the various Branch Farms for further trial and for the rejection of any of them which are found to be unsuited to the local conditions.

When the Dominion Experimental Farms were first established, the settlement of the great prairie country of central and western Canada had not progressed very far, and there were various problems of vital importance connected with the growing of wheat on the plains which awaited investigation. Hence it was natural that special attention should be paid to these new sections of country. While, therefore, the needs of the older farming districts have not been overlooked, and results of value to them have been reached along various lines of research, the most interesting branches of our work have been those concerning the great wheat-growing plains. The short summer of the prairies emphasized the need for early maturing varieties of wheat, while the long distance between the farmer and the main centres of wheat consumption made it essential that only such varieties should be grown as would command an exceptionally high price in the world's markets, so that the cost of transporting the grain would be relatively low.

The prairie settlers found the famous Red Fife wheat very satisfactory on the whole, except in regard to the time taken to mature the crop, which, in the less favourable seasons, was rather too long; so that the fields were sometimes touched with frost before the grain was ready to be cut, thus very seriously lessening the farmers' income. In hardness of kernel and in flour strength (the characteristics which perhaps chiefly determine the selling price of any wheat) this variety ranks at the head of its class. What was needed, therefore, for the great wheat-growing plains was an early Red Fife, a variety having all the good qualities of ordinary Red Fife with the added excellence of earliness.

To meet this need, early ripening varieties of wheat were imported from various countries by the Director of the Experimental Farms and, at as early a date as possible, experiments in cross-breeding were begun for the purpose of combining in one sort all the desired qualities. Naturally, Red Fife was used as one of the parents in the majority of the crosses which were effected, for, from a commercial point of view, this wheat possesses perhaps more good qualities than any other well-known kind.

None of the early wheats imported from other countries proved satisfactory for our conditions, although some of them have been found of great value in cross-breeding. The new and improved varieties which have been or are being given to the public have, therefore, been produced either by cross-breeding (followed by selection) or by the mere selection of superior strains out of existing sorts. Both of these lines of work have given valuable results, though selection alone, however satisfactory it may be in a theoretical way, has been found to be quite limited in its practical possibilities.

The work of cross-breeding was begun by Dr. Wm. Saunders (the Director of the Experimental Farms) and his assistants in the year 1888. The principal crosses which were made at that time were between Red Fife wheat (or White Fife, which is an almost identical sort) and an early-ripening variety which had been obtained from Russia. Some years later other crosses were effected, but the main interest has thus far been centred in the progeny of the first crosses, especially the varieties known as Stanley, Preston and Huron, which are now widely distributed throughout the western provinces and which have contributed largely to successful wheat growing in many of the less favoured localities during the past few years.

In the earlier years of this wheat-breeding, when the principles of heredity were not so well understood as they are at present, the system of selection after crossing was not so thorough as that now known to be necessary. The cross-bred varieties first introduced were, therefore, not quite fixed in some essential respects, and it devolved on the writer of this paper, who was appointed in the year 1903 to take charge of the work with cereals, to reselect all the varieties of wheat obtained from the crosses effected up to that time. By this reselection, on Mendelian lines of course, the early cross-bred wheats have been distinctly improved, and the best of the new, selected strains combined to a very large extent the good qualities of both parents. Stanley, Preston and Huron, as now grown at the Experimental Farms, are vigorous, early sorts, ripening a few days—or sometimes nearly two weeks—before Red Fife, and having hard, bright kernels of the popular reddish-brown shade. In yield of grain per acre they often surpass Red Fife, even when the conditions are favourable to the latter sort, and in yield of flour in the mill they are quite satisfactory. In one respect, however, they are all somewhat inferior to Red Fife, from a commercial point of view; for while they produce flour of good quality it does not usually possess the remarkable baking strength which generally characterizes Red Fife flour. Preston and Huron have a further, but not very serious, disadvantage of yielding flour of a deeper yellowish colour than that made from Red Fife. Stanley gives flour of the same shade as Red Fife.

In addition to the three new varieties just mentioned, which inherited their early-maturing qualities from a wheat from Northern Russia, reference should be made to three other cross-bred sorts, the value of which has recently been demonstrated. These are Marquis, Chelsea and Bishop, varieties which owe their earliness largely to the fact that one of the parents in each case was a very early wheat obtained from India. Marquis and Chelsea are descended in part from Red Fife. Bishop is an Indo-Russian cross. Of these newer varieties, Marquis is perhaps the most important, showing distinct superiority over the cross-bred varieties first introduced in regard to the character of the flour produced from it, which both in strength and in colour is practically identical with Red Fife. Comparative baking tests carried on last winter with samples from the crop of 1908 showed that Marquis grown at Brandon, Manitoba, was equal in colour and strength of flour to Red Fife grown on the same farm and was superior to Red Fife grown at Indian Head, Saskatchewan. The differences observed were not very great and might perhaps be reversed another season, but the high strength of Marquis is fully established by these and previous tests. Marquis is a beardless wheat, having hard, red kernels and resembling Red Fife in all respects, except that it is earlier in ripening. It ripens about with Stanley, Preston and Huron.

Chelsea is a very early, beardless wheat which has been found satisfactory in all respects except flour strength, in regard to which it ranks about with Stanley and Preston. It closely resembles the new, selected strain of Stanley, but seems to be earlier and perhaps more productive than that variety.

Bishop is a still earlier wheat, possessing many good qualities, its remarkable productiveness being of special interest. It gives a rich-looking, yellowish flour of good strength, but not equal to the strongest varieties. In spite of its many admirable qualities, the fact that it possesses a pale, yellowish skin prevents us from advising farmers to grow it for export, because the Canadian grain inspection laws are based on the idea that wheats with a pale skin are usually of inferior quality, and the regulations in regard to the grading are so worded as to make it practically impossible for any farmer to obtain a fair price for a yellow (or so-called 'white') wheat, in what is known as the Manitoba Inspection Division. Bishop has succeeded remarkably well at almost all points where it has been tested. As an instance of special interest, I may mention that a large yield per acre of grain weighing 65 pounds to the measured bushel was obtained from this variety last season at Lesser Slave Lake in a latitude about 400 miles farther north than Winnipeg. No doubt it will succeed very well much farther north than this.

These new varieties and new strains of the older sorts are now being propagated for free distribution. Most of them were available to a limited extent for that purpose last winter. At present it appears that Marquis may take the lead as the best for export purposes of all the early sorts yet introduced, unless the selected form of Red Fife, mentioned later in this paper, should prove equally early. These two varieties are very much alike, though of quite distinct origin.

In addition to the six varieties of wheat mentioned by name, which have all sprung from crosses made in the earlier years of the existence of the Experimental Farms, we have now on hand a large number of very promising varieties which have been produced from crosses made by the writer in more recent years. About 200 of these new sorts are now being propagated for further test, and these will probably soon be followed by several hundred others, from the progeny of the most recent crosses which at the present time are not quite fixed in type. Of course it is not our intention to retain more than a few new varieties, adapted to the various conditions of soil and climate in Canada. The task of eliminating the less desirable sorts will, therefore, be rather lengthy and difficult, especially as the baking strength of the flour must be considered in nearly all cases.

When this work was commenced, the strength of the flour from any wheat could not be determined until quite a large quantity of grain was available and even then we were dependent on the mere opinion of some commercial baker, not usually a trained scientist, as to the characteristics and value of the flour. Now, however, with the introduction of the small experimental flour mill and the development of a scientific method of determining baking strength, this matter can be investigated much earlier in the history of each variety, and the conclusions reached are far more trustworthy than before. All new varieties intended for bread-making are now tested in the baking laboratory before being distributed. In addition to the final baking tests, I have employed for several years a simple chewing test (using only a few kernels of wheat) as a valuable guide to gluten strength and probable baking strength in the earlier stages of selection. This test was advocated as an essential aid in the selection of cross-bred varieties of wheat in the bulletin on Quality of Wheat, published at Ottawa, October, 1907.

The practical results already reached by the introduction of early-maturing wheats are of considerable importance, since the new varieties here referred to can be depended upon to ripen in some of those sections of country where the old, standard variety Red Fife is often caught by frost. By the use of these earlier kinds, the areas of profitable wheat culture have been extended. Furthermore, a small acreage of some

of the new sorts may be advantageously sown, especially on stubble land, even in districts where Red Fife succeeds fairly well, so as to lengthen the harvesting season when labour is scarce; but, with the possible exception of Marquis, none of the new cross-bred sorts thus far introduced can be recommended to replace Red Fife in localities where that variety can usually be ripened.

As an instructive proof of the value of early-maturing wheats, some results obtained last season on the Experimental Farm at Lacombe in Central Alberta may be cited. All the spring wheat on that Farm was somewhat blemished by frost with the exception of one early variety. This wheat, known as Downy Riga, was cut before the first frost. The kernels were plump and bright with a smooth skin and weighed 63½ pounds to the measured bushel. Among the early varieties which ripen later than Downy Riga, we may take Huron as a good example. This wheat was so well advanced at the time of the frost that the kernels when threshed were found to be quite plump and weighed 62 pounds to the measured bushel. The bran was, however, so much roughened by the frost that the wheat would have been graded quite low if offered for sale. Red Fife from the same series of plots was very seriously damaged by the frost, the kernels being rather shrivelled and the bran somewhat rough. The weight of a measured bushel of this wheat was only 58½ pounds, and the yield 18 bushels per acre. Downy Riga gave 31 bushels and Huron 37½ bushels per acre.

While the results achieved thus far are of great value, still further advances are expected in the near future. Some of the new, hard, red, early wheats derived from the writer's recent crosses are to be ground and baked during the coming winter, and it is expected that from 50 to 100 new sorts will be tested in this way every year for several years to come. Out of this large number we may confidently look forward to the discovery of at least a few varieties which will surpass any of those yet known by combining all the good qualities needed in an early-maturing wheat for export.

Though it is true that cross-breeding is quite essential when one wishes to produce new varieties of wheat which shall be radically distinct from any existing sorts, one may occassionally isolate by mere selection some fairly distinct type (a 'sport' or a 'mutant') which may be, in certain respects, superior to the variety out of which it was selected. A considerable amount of selection has been carried on at Ottawa, and, though on the whole the practical results of this work have been much less than those obtained from cross-breeding, one at least of the new strains produced by simple selection promises to be of importance, and ranks in interest with the cross-bred sorts. This is a strain of Red Fife wheat originated from a single early-maturing plant found by the writer in 1903. This strain has been thoroughly tested both in the field and in the baking laboratory and has been proved to be genuine Red Fife in all essential respects. It, however, ripens earlier and shows certain other minor points of difference, but would be generally recognized as Red Fife. This wheat has now been grown for six years at Ottawa and was tested during the present season at Brandon also. Though we do not yet know what its average yield will be, it is a strong grower and promises well. Its advantage in earliness over common Red Fife is only a few days under ordinary conditions, by no means sufficient to meet the needs of all districts, but quite enough to establish the value of the new selection and to create a large demand for it. It has been named Early Red Fife and will, it is expected, be available for general distribution in small quantities after the next harvest, only a few bushels of seed being now on hand.

It would be quite in accord with popular ideas if we were to carry on repeated selections of Early Red Fife for earliness through several years or decades in the hope of obtaining still further advances in that direction. Unfortunately, while improvement by such a method is perhaps not quite impossible, there are good grounds for believing that the further advances would 'tease the patience of the centuries' before any striking results would be obtained. Early Red Fife did not, in all prob-

ability, acquire its earliness by degrees, but at one step, at the same time as its other points of difference from the parent variety were manifested. In introducing this variety I do not claim that I have improved Red Fife wheat, but that I have discovered and isolated an improved type which had previously been mixed with the ordinary form. It is from cross-breeding followed by selection that one may expect the greatest advances in the direction of any desired change, and it is to cross-bred varieties, therefore, that we must look for still earlier wheats of high baking strength.

Leaving now what may be called the practical side of the subject (though the attempt to distinguish sharply between practical and scientific results is rather objectionable and at times misleading), we may turn to some of the observations of a scientific character which have been made during the progress of this work. While in many cases observations and descriptions which would have been of value have been unavoidably omitted or seriously curtailed, owing to the pressure of other aspects of the work, nevertheless some facts of scientific interest have been noted from time to time. Since the work has been done on a large scale it is not surprising that some of the observations made are in disaccord with those of my predecessors and co-workers in other parts of the world. The number of cross-bred kernels of wheat which I have produced thus far is over three hundred. The many thousands of descendents raised from these have given opportunity to make observations of a varied character and to discover some irregularities which might have escaped notice in any small series of experiments.

In regard to the inheritance of awns, I have already presented elsewhere a summary of the facts observed, and I wish at this time merely to repeat the statement that awns and the absence of awns do not necessarily form a pair of Mendelian unit characters, but that an intermediate condition is quite common (in wheats of cross-bred origin) in the first generation and also in succeeding generations.*

In reference to the inheritance of baking strength I have recently had occasion to present some facts for publication in one of the scientific journals, and it is therefore unnecessary to give more than a brief summary of my views on this occasion. In this matter, as in the study of the inheritance of awns, my work has been of an unusually extensive character, and has led to conclusions at variance with those arrived at by some other students of the same problem. It has been asserted that strength and weakness of flour form a pair of Mendelian unit characters. Even after making all due allowance for the necessarily somewhat indefinite meaning of the words *strong and weak*, it seems impossible to accept this view. If it were true, it would lead to the saving of a large amount of time in working out some of the problems of wheat breeders. But, after having studied with great care several of our cross-bred wheats produced by crossing a strong with a weak variety, I have failed to find one which has inherited the full baking strength of the strong parent. The baking strength has usually been found to be intermediate between the two parents, quite far enough from both extremes to avoid any possible doubt. The baking tests have been made entirely by myself and have been quite elaborate, having involved the making of some hundreds of test loaves through several years. The results are the more striking when we remember that all the cross-bred varieties tested were selected originally by the chewing test as having gluten which in strength approached nearest to that of the strong parent.

These tests were, of course, conducted with pure, fixed strains propagated from single plants and showing a remarkable degree of uniformity. While it is to be regretted that baking strength does not act as a simple Mendelian character, it would indeed be most surprising if it were so, in view of the fact that it depends not only

* The half bearded condition may, of course, be described as a case of 'incomplete dominance.' But such a description is little better than playing with words, and admits all that the present writer contends; namely, that beardlessness is not always dominant in the first generation. Half dominance is, of course, no dominance at all.

on the quantity and quality of the gluten, but is greatly influenced by other factors such as climate and storage, and that the weak flour of to-day may be completely transformed by being kept for a year, and may be in the very highest class for strength the following season.

I am a strong believer in the value of Mendel's observations, but cannot help feeling that the supposed discovery of Mendelian unit characters is sometimes due to the unhappy combination of a great deal of enthusiasm with very few facts. It is essential that many observations should be made and that the 'exceptional' cases should be taken into account—especially when they are in the majority.

Among other irregularities in inheritance, two may be mentioned which occur so frequently as to suggest that they may perhaps be *regularities* after all. When two varieties of wheat having reddish bran are crossed, it often occurs that in the second and later generations some of the progeny have yellowish bran. In regard to awns a somewhat similar phenomenon is often observed, namely, the appearance in the second and later generations of fully bearded plants, both the parent varieties having been practically awnless. In such cases I have never witnessed the production of intermediate or half-bearded types which are so common when bearded and beardless sorts are crossed. Perhaps the occasional production of downy chaff when two varieties with smooth chaff have been crossed may also belong in this same category, though it appears to be less common.

While it is somewhat unsatisfactory to report upon work which is yet so far from completion (using that term in a very loose sense of course) and which indeed is now just reaching the period of greatest interest, during which the most rapid advances may be expected, I have endeavoured, nevertheless, to make clear to you the aim and scope of the work in wheat breeding which I am carrying on and also to give you some idea of the progress which has thus far been made and of the results of practical and scientific interest which have been obtained. Very much yet remains to be done before even the most urgent needs of Canada shall have been met, but in view of the advances that have already been made we may look confidently to the future for a decided improvement in the character of the grain produced in many sections where wheat is now being cultivated, and also for a great extension of profitable wheat growing into districts where at present the high altitudes or high latitudes are a bar to the successful cultivation of this most important cereal.

CROSSING AND SELECTION OF CEREALS.

The principal crosses made last season were between Red Fife wheat and Persian Black for the purpose of studying the inheritance of chaff colour. This problem is rendered very difficult owing to the fact that the true colour of the chaff is often obscured by the effects of unfavourable weather or disease. It is hoped, however, that the parents chosen for this experiment are sufficiently diverse in chaff colouration to make accurate observations possible.

The crosses made the previous season between different selected strains of Red Fife wheat were successfully grown last year. Most of the plants were quite healthy and some of them showed distinctly that they were true crosses, as they had inherited from the male (or pollen) parent a type of head distinctly more blunt than that of the female (or seed) parent. As a rule, one cannot be quite certain that a cross within a variety has been effected even when all possible precautions have been taken. Indeed it is probable that many of the supposed crosses within a variety have been fertilized with pollen from the same flower or from other flowers of the same plant. It will be interesting to follow the history of these new crosses to see whether they show any peculiar tendencies or any unusual vigour. So much has been said in Canada of late years in regard to the supposed weakening of cereals by

repeated self-fertilization year after year and the supposed necessity for renewing the vitality of the seed by crosses within the variety, that it seems desirable to point out that such assertions are to be regarded as mere expressions of opinion without any substantial foundation. It is absurd to argue that because unnatural in-breeding is sometimes dangerous in animals, therefore the perfectly natural self-fertilization in cereals must necessarily be open to the same objections. Self-fertilization is the rule in cereals, but it has been clearly proved by scientific workers in various countries that cross-fertilization occasionally occurs. Several striking cases of this have come under the observation of the writer. It has, however, never yet been demonstrated that cross-fertilization is necessary in cereals for the maintenance of vigour.

Considerable work in selection was carried on during the past season, but this subject was so fully discussed in the annual report for last year that detailed references to it are unnecessary at the present time.

SPECIAL DISTRIBUTION OF SEED GRAIN.

As announced last year, the Cerealist is prepared to send by mail small samples of seed of the very best strains and of the highest degree of purity to farmers who are in the habit of growing seed grain for sale and who are prepared to handle such unusual grain with the care it deserves. Such seed cannot be sent out in quantity, by the bushel, as the amount on hand is always, necessarily, very small. Most of it is grown at Ottawa under the immediate care of the Cerealist, and represents the results of the best methods of breeding and selection. Farmers desiring grain to use as a basis for experiments in selection are not advised to commence their operations with these special strains of seed which are already so highly selected that they cannot be expected to respond readily to any further work of that kind. This special seed should be propagated as rapidly as possible without selection, but giving great care to the maintenance of its purity. Farmers desiring a sample of this special seed should state the name of the variety they wish, or the particular qualites which they desire. It is hoped that there will be available next season several varieties of wheat and one or two sorts of barley and of oats for this distribution.

MILLING AND BAKING TESTS.

Since the last report was written a new laboratory has been fitted up for carrying on the baking tests. There has been provided a larger and better oven, heated by electricity, and so constructed that the temperature can be easily controlled and kept fairly constant. Other improvements in apparatus have also been made, so that the work can now be carried on more easily, with greater accuracy and on a larger scale than before.

The number of milling and baking tests conducted this year was unusually large, and it is therefore thought best to reserve a detailed account of them for some future publication, and to refer here to only a few of the most important observations and conclusions.

TESTS OF NEW AND STANDARD VARIETIES OF SPRING WHEAT.

Milling and baking tests were made of fifty new, unnamed, cross-bred varieties of spring wheat and of a considerable number of named varieties as well. In the following table a few particulars are given in regard to some of those sorts which stood highest in rank. They are all of the 1909 crop. It will be noticed that several of the new, cross-bred varieties produced stronger flour than any of the samples of Red Fife tested, and in several cases the colour of the bread from the cross-bred wheats

was also remarkably good. The propagation of these phenomenally promising wheats will be pushed as rapidly as possible. Most of them ripen very much earlier than Red Fife and give a good yield of hard, red kernels. Their hardness as compared with Red Fife is roughly indicated by the percentage of break flour obtained. Only one of them, 86 D 2, yielded soft flour, but this is a most unique type, as the softness is here associated with high baking strength.

The very high baking strength of Kubanka, the only Durum wheat in the list, should be noted. The low mark given to this variety for colour is not an expression of the Cerealist's personal opinion, but merely an attempt to indicate the probable rank of the bread from an ordinary commercial standpoint. The bread was of a rich, attractive, bright yellowish colour.

The varieties are arranged in the table in the order of their rank for baking strength as determined according to the method described in Bulletins 57 and 60 of the Experimental Farm series.

TESTS OF NEW AND STANDARD VARIETIES OF SPRING WHEAT.

Milling number.	Variety.	Where Grown.	Break Flour per cent.	Baking strength of flour.	Colour of bread inside.
339	135 B (Gehun Downy x Fraser)	Ottawa	11·0	103	91
336	378 A (Downy Riga x Red Fife)	"	11·0	102	97
292	354 C (Downy Riga x Red Fife)	"	9·9	102	91
263	Kubanka (durum)	"	4·1	102	90
335	195 F (Riga x Preston)	"	13·0	101	96
320	397 D (Downy Riga x Percy)	"	7·7	101	94
297	128 B (Gehun Smooth x Prospect)	"	11·1	100	99
279	Early Red Fife	Brandon, Man	9·0	100	97
323	83 E (Red Fife x Downy Riga)	Ottawa	10·9	100	95
255	Red Fife H.	"	13·0	99	99
322	107 A (Gehun Smooth x Preston)	"	8·9	99	95
257	199 B (Riga x Preston)	"	10·2	99	99
266	410 B (Downy Riga x Preston)	"	9·8	97	98
273	Red Fife	Indian Head, Sask	13·5	97	98
341	86 D 2 (Red Fife x Downy Riga)	Ottawa	13·9	97	96
325	363 E 1 (Downy Riga x Red Fife)	"	8·3	97	96
303	197 C (Riga x Preston)	"	10·0	97	91
305	129 D (Gehun Smooth x Prospect)	"	5·7	96	96
307	Red Fife (ordinary seed)	"	10·3	96	95

EFFECT OF STORAGE ON WHEAT AND FLOUR.

The experiments which have now been going on for several years to determine the effect of storage under various conditions on the baking strength of flour have been continued this year, and a new series has been added to the tests in order to gain further information on some points not yet made clear.

The results this season of the baking tests of the stored samples confirm the conclusions of previous years as to the beneficial effect of storage on colour of flour and on baking strength, whether the material is kept as flour or as wheat. It is evident that, under proper conditions of storage, wheat and flour continue to improve for considerably more than a year.

DAMP WHEAT.

Two new series of damp wheat tests were carried on. The results obtained agreed with those of the first series, reported upon last year, and showed that wheat can be subjected to a very considerable amount of dampness, or actual soaking in water, with-

out causing the flour to lose any of its baking strength, while under certain conditions a distinct gain in strength is observed. Some light was thrown on the cause of this gain by the discovery that the addition of a very small amount of malt flour to the flour made from the original sample of wheat (which had not been rendered damp) produced bread almost identical with that made from the damp wheat without the addition of malt. The addition of malt flour to the samples of flour made from the damp wheat produced little or no effect.

INFLUENCE OF FERTILIZERS ON FLOUR STRENGTH.

A series of tests was carried on to ascertain whether the degree of fertility of the soil on which wheat was grown, or the addition to the soil of any particular fertilizer would have any appreciable influence on the baking strength of the flour.

Without attempting to give at present any of the details of these tests, the general conclusions drawn from them may be stated; namely, that no striking influence was observe from any form of fertilizer and that exhausted soil produced flour of unimpaired baking strength.

ARTIFICIAL BLEACHING OF FLOUR.

Since a good deal of public interest has been aroused in the artificial bleaching of flour, some rather extensive tests were undertaken to determine what effects such bleaching might have upon the bread-making qualities of any sample of flour. The only method of artificial bleaching commonly used is by means of nitrogen peroxide generated by the decomposition of nitric acid, or, more frequently, by subjecting air to what is called a flaming discharge of electricity, which brings about a combination between very small portions of the nitrogen and oxygen of the air. The air which has been so treated and which contains a little nitrogen peroxide is passed through a rotating cylinder where the flour is kept in constant motion. The flour is subjected to the action of this air for about fifteen seconds, but the bleaching is practically instantaneous.

Through the courtesy of the Alsop Process Company, the owners of the Canadian patents covering this process, some samples of different types of flour were bleached for the writer (in his presence), last December. Only half of each lot of flour was bleached, the remainder being kept for comparison.

Six lots of flour were treated—a high grade patent flour from Manitoba spring wheat, a soft flour made from Ontario winter wheat, and four samples produced in the experimetnal flour mill belonging to this division, from different types of spring wheat. After having been stored for about three weeks under the usual laboratory conditons, repeated baking tests were made of the bleached and unbleached samples of flour.

Without giving at this time the exact figures obtained, it may be said that the bleached samples showed no distinct differences from the unbleached, except in the colour of the flour and bread which was always less creamy or less yellowish in the case of bleached samples. In some instances, the bleached flours appeared to be very slightly stronger for bread making than the unbleached, and in others they appeared to be very slightly weaker, but the differences observed were all extremely slight and probably within the limits of unavoidable experimental error. Certainly the artificial bleaching, while giving to the flour a paler tint somewhat like that which is produced by natural bleaching, does not impart the increased strength which flour almost always obtains from prolonged storage under good conditions. On the other hand, it is equally clear that artificial bleaching, properly carried out as in the samples

examined, does not appreciably injure the bread-making strength of the flour. Bleaching had no effect, so far as could be observed, on the flavour of the bread.

This subject is of such importance that a full discussion of it is necessary. This must, however, be reserved for some later publication.

SMALL PLOTS OF CEREALS.

In addition to the very numerous plots of cereals of cross-bred origin which are not yet fixed in type, there were grown at Ottawa last year in plots of less than 1/60 of an acre:—

28 selected strains from named varieties of spring wheat.
222 new cross-bred varieties of spring wheat.
23 selected strains from named varieties of oats.
21 new cross-bred varieties of oats.
45 selected strains from named varieties of barley.
80 new cross-bred varieties of barley.
24 new cross-bred varieties of peas.
3 selected strains from named varieties of beans.
20 selected strains from commercial sorts of flax.
Making a total of 119 selected strains and 347 new cross-bred varieties.

UNIFORM TEST PLOTS OF CEREALS, &c.

The most important varieties of cereals, field roots, &c., which are obtainable in commerce are grown every year in test plots along with the cross-bred and selected sorts produced at this Farm and other varieties obtained from various sources. The objects of these tests are to determine the relative productiveness, earliness, &c., of the different varieties. Those which for a series of years are found to be distinctly inferior are rejected, in order to keep the list within as small bounds as possible.

The test plots of grain are one-sixtieth of an acre and those of field roots one-hundredth of an acre.

The number of these test plots grown during the past season was as follows: spring wheat, 31; durum wheat, 3; winter wheat, 13; emmer and spelt, 8; oats, 36; six-row barley, 17; two-row barley, 23; peas, 21; spring rye, 3; winter rye, 3; field beans, 4; turnips, 25; mangels, 26; carrots, 11; sugar beets, 6; Indian corn, 41; making a total of 271 plots and representing about 200 varieties.

The number of grain plots has now reached the lowest point for many seasons, owing to the steady elimination of the less desirable sorts during the past few years. A considerable increase in the number will occur this coming season, now that some of the new cross-bred varieties produced since the establishment of the Cereal Division are ready to take their places in these larger plots.

WEATHER.

The spring of 1909 was very backward, chiefly owing to the unusual quantity of rain which delayed the sowing of grain some weeks beyond the proper time. It was nearly the middle of May before the first plots were sown.

Fortunately the summer proved exceptionally favourable, so that, on the whole, fair crops were obtained in spite of the late seeding, which under ordinary circumstances would have proved disastrous.

SPRING WHEAT.

EARLY RIPENING VARIETIES.

Marquis proved remarkably successful at many points last season, the yield of over 200 bushels from a 4-acre field on the Brandon Experimental Farm being worthy of special notice. Several farmers in Northern Saskatchewan grew it with unusually good results. The best sample which reached the Cerealist's office was grown by Mr. E. B. Cay at Beatty, Sask., and showed the phenomenal weight of 66¼ pounds to the measured bushel. Other very fine samples were received from Mr. Martin Dornian, of Disley, Sask. (65 pounds per bushel), and from Mr. L. T. Symonds, of Marshall, Sask. (64¾ pounds per bushel). In addition to its earliness, Marquis wheat is very desirable in certain sections on account of its somewhat shorter straw than Red Fife. Its good appearance and excellent baking records have been discussed in previous reports.

Taking all points into consideration, Marquis wheat is recommended as the most promising sort at present available for farmers who require a hard, red wheat of high baking strength and ripening earlier than Red Fife.

Early Red Fife, which is a selection from Red Fife and was produced by propagation from a single conspicuously early plant, is similar to Marquis in many ways. It has not yet been quite so thoroughly tested, but may prove equal to or even better than Marquis. A limited distribution of five pound samples of Early Red Fife is expected to be made next December.

Preston, Huron and Stanley, by careful reselection, have been considerably improved and are excellent varieties from nearly all points of view. Under ordinary conditions, however, they do not produce flour of the highest baking strength, a disadvantage the seriousness of which can easily be exaggerated, but which should not be overlooked in those districts where wheat is grown for export and where a reputation for remarkably high baking strength has already been established. This applies particularly to the central parts of Canada. For the Atlantic and Pacific provinces, these varieties can be recommended as superior to most of the sorts commonly grown. Preston and Huron are bearded wheats, but are particularly vigorous and productive.

Percy and Chelsea are very good early varieties, which have failed, however, to display such distinctive qualites as would necessitate their continued cultivation. These sorts have, therefore, been withdrawn from the distribution.

Bishop is a very early beardless wheat which has given exceptionally high yields and is deserving of attention in those parts of Canada where there is no prejudice against 'white' varieties. Although of a pale colour, this is not a soft wheat.

SPRING WHEAT—TEST OF VARIETIES AT OTTAWA.

Owing to continued wet weather the plots were not sown until May 14. The seed was used at the rate of about 1½ bushels to the acre. The soil was a loam of medium character.

Varieties without names are new cross-bred sorts produced by the Cerealist, but which are not yet ready for distribution. Those varieties which have a letter after the name are new strains propagated from single selected plants.

The yield per acre is expressed in pounds and also in 'bushels' of 60 pounds.

The character of the straw is indicated by marks on a scale of 10 points, according to the proportion of the plot standing erect at harvest time.

* Varieties and selected strains produced at the Central Experimental Farm are marked with an asterisk.

SPRING WHEAT.—TEST OF VARIETIES.

Number.	Name of Variety.	Date of Ripening.	No. of Days Maturing.	Average Length of Straw, including Head.	Strength of Straw on a Scale of 10 Points.	Average Length of Head.	Yield per Acre.	Yield per Acre.		Weight per Measured Bushel after Cleaning.	Rusted.
				In.		In.	Lb.	Bush.	Lbs.	Lbs.	
1	Early Russian*	Aug. 17	95	48	4	3½	2370	39	30	61	Badly.
2	Huron Selected*.......	" 20	98	48	9	3¾	2100	35	..	62	"
3	Marquis*...	" 17	95	46	10	3½	2040	34	..	60	Considerably.
4	Aurora*...	" 6	84	40	7	3	1950	32	30	56½	Slightly.
5	Ebert Selected*.......	" 7	85	44	9	3½	1950	32	30	59	"
6	Preston H*...........	" 14	92	43	10	3½	1950	32	30	60¾	"
7	Outlook*.............	" 24	102	46	8	3½	1860	31	..	61	"
8	Bishop A*....	" 13	91	52	6	3¼	1830	30	30	60½	"
9	Hungarian White	" 20	98	47	6	3½	1830	30	30	61	Badly.
10	Prospect*...	" 9	87	44	10	3½	1830	30	30	59½	Considerably.
11	Percy A*..........	" 17	95	47	10	3¾	1800	30	..	60¼	Slightly.
12	Pringle's Champlain C*	" 14	92	40	9	3½	1710	28	30	61½	"
13	Downy Riga*	" 7	85	43	6	3¼	1680	28	..	60	"
14	Bobs	" 16	94	47	9	3½	1650	27	30	61	Considerably.
15	Chelsea*........... .	" 16	94	47	4	3½	1620	27	.	60½	"
16	Stanley A*...........	" 17	95	42	10	3½	1500	25	..	57¼	Slightly.
17	Gatineau*....	" 26	104	47	3	4	1440	24	..	59	Considerably.
18	Red Fife H*	" 25	103	43	10	3½	1410	23	30	58¾	"
19	9 G*........	" 20	98	45	10	2¾	1350	22	30	57½	"
20	Alpha Selected*..	" 20	98	50	8	3½	1350	22	30	57	Badly.
21	Early Red Fife*.. . . .	" 17	95	40	10	3½	1350	22	30	58½	Considerably.
22	Yellow Cross*	" 14	92	39	10	3	1230	20	30	61¾	Slightly.
23	Red Fife M*	" 26	104	43	10	3½	1140	19	..	58¼	Considerably.
24	Yellow Fife*	" 6	84	41	10	3¼	1140	19	..	58	Slightly.
25	Yellow Queen*.	" 12	90	43	10	3¼	1140	19	..	62	Considerably.
26	White Fife C*....	" 26	104	40	10	3½	960	16	..	58¼	"
27	7 E 3*...............	" 23	101	44	8	3½	750	12	30	57	"

The average yield of the 27 plots was 1,590 lbs. (26 bush. 30 lbs.) per acre.

MOST PRODUCTIVE VARIETIES OF SPRING WHEAT.

Excluding the durum wheats, which are considered separately, the following varieties of wheat have shown unusual productiveness for a series of years on this Farm: Preston, Pringle's Champlain, Huron and Bishop. The first three of these are hard red wheats with bearded heads. Bishop is a very early white wheat and is beardless. Of the four varieties Pringle's Champlain is probably the best for the production of strong flour.

Somewhat lower in yield, but superior in the strength of their flour, are Red Fife, Marquis and White Fife, all beardless.

EARLIEST VARIETIES OF SPRING WHEAT.

Some of the very early kinds of spring wheat grown on this farm are not at present being distributed or recommended for general cultivation. Farmers applying for very early sorts should remember that extreme earliness is frequently associated with a rather small yield, short straw, liability to rust or some other defect to which the more vigorous wheats are less subject.

The earliest wheats which are included in the regular distribution of seed grain from this Farm are Marquis and Stanley (beardless and having red kernels), and

Preston, Huron and Pringle's Champlain (bearded and having red kernels). Bobs and Bishop are early beardless sorts which are not generally distributed, because the pale colour of their bran would cause them to be graded below their actual value in the Manitoba Inspection Division. Bishop is perhaps the earliest of the seven varieties mentioned, but they are all earlier than Red Fife.

DURUM OR MACARONI WHEAT.

The different varieties of durum wheat are by no means identical in quality, though they are usually considered to be so. Some are particularly good for the making of macaroni, and excellent bread (of a rich, yellowish colour) can be made from others, but some of the varieties are not very good for either of these purposes. Kubanka (Beloturka) is one of the best for bread making and for macaroni.

The extreme hardness of these wheats and the yellowish colour of the flour produced from them make them quite unpopular at present with both millers and bakers.

Farmers who grow durum wheat should obtain one of the best varieties and should exercise great care to prevent the grain from becoming mixed with wheat which is to be sold for the making of ordinary flour.

As a rule, the durum wheats suffer less from drought and from rust than other sorts. They may, therefore, prove useful in some cases, especially in any rather dry districts where rust is apt to be severe. They are not, however, to be recommended for damp climates. It should also be borne in mind that the market price of durum wheat is usually lower than that paid for varieties which are popular for milling purposes.

Several of the varieties which have been shown to be inferior to the others have been discontinued.

The plots of durum wheat were sown on May 13, the seed being used at such a rate as would be equivalent to 1¾ bushels per acre of seed of high vitality. The climate at Ottawa is usually too damp for these wheats and the seed saved is generally of rather low vitality. The soil was a loam of fair quality.

The yield per acre is expressed in pounds and in 'bushels' of 60 pounds.

DURUM WHEAT.—TEST OF VARIETIES.

Number.	Name of Variety.	Date of Ripening.	No. of Days Maturing.	Average length of Straw, including Head.	Strength of Straw on a Scale of 10 points.	Average length of Head.	Yield per Acre.	Yield per Acre.		Weight per measured bushel after cleaning.	Rusted.
				Inches.		In.	Lbs.	Bush.	Lbs.	Lbs.	
1	Roumanian............	Aug. 26	105	52	7	2⅓	2,190	36	30	62	Slightly.
2	Goose................	" 24.	103	50	7	2¾	1,920	32	00	61	"
3	Kubanka............	" 25.	104	46	7	2½	1,860	31	00	61	"

The average yield of the three plots was 1,990 lbs. (33 bush. 10 lbs.) per acre.

The variety called Roumanian has given the highest average yield at Ottawa during the past five years. It is, however, of poor quality for bread and probably also for macaroni and should not be grown for any but feeding purposes.

WINTER WHEAT.

Several of the varieties which have been found to yield flour of low baking strength have been dropped from the list.

The plots of winter wheat were sown on August 25, 1908, the seed being used at the rate of about $1\frac{3}{4}$ bushels to the acre. The soil was a rather heavy loam. The very dry weather which occurred in the month of September, 1908, interfered with good germination and growth. The early part of the winter was changeable in character, so that the plots suffered considerably at that time. Under such circumstances, a uniformly high yield from the plots was not to be expected. Good results were, however, obtained in most instances.

The yield per acre is expressed in pounds and also in 'bushels' of 60 pounds.

WINTER WHEAT.—TEST OF VARIETIES.

Number.	Name of Variety.	Date of Ripening.	No. of Days Maturing.	Average length of straw, including Head.	Strength of Straw on a Scale of 10 points.	Average length of Head.	Yield per Acre.	Yield per Acre.		Weight per measured bushel after cleaning.	Rusted.
				Inches.		In.	Lbs.	Bush.	Lbs.	Lbs.	
1	Tasmania Red	Aug. 1.	341	46	6	$3\frac{3}{4}$	3,000	50	0	$62\frac{1}{2}$	Slightly.
2	Jones' Winter Fife.....	July 29	338	50	10	$3\frac{1}{2}$	2,940	49	0	$61\frac{3}{4}$	"
3	Red Velvet Chaff	Aug. 2	342	47	10	$4\frac{1}{4}$	2,760	46	0	$60\frac{1}{2}$	Consid'ably.
4	American Banner .. .	July 30	339	49	10	$3\frac{3}{4}$	2,640	44	0	$60\frac{3}{4}$	Slightly.
5	Imperial Amber........	" 29.	338	55	10	$3\frac{1}{2}$	2,610	43	30	$62\frac{3}{4}$	"
6	Buda Pesth	Aug. 2.	342	50	10	$3\frac{1}{2}$	2,520	42	0	$61\frac{3}{4}$	"
7	Egyptian Amber...... .	July 30.	339	52	10	$3\frac{1}{2}$	2,490	41	30	62	Consid'ably.
8	Turkey Red No. 380.. .	Aug. 2	342	42	6	3	2,490	41	30	$63\frac{3}{4}$	Slightly.
9	Dawson's Golden Chaff.	July 30.	339	47	10	$3\frac{3}{4}$	2,460	41	0	61	Consid'ably.
10	Early Red Clawson.....	Aug. 2.	342	46	10	$3\frac{1}{2}$	1,650	27	30	$59\frac{3}{4}$	Slightly.

The average yield of the ten plots was 2,556 lbs. (42 bush. 36 lbs.) per acre.

RECOMMENDED VARIETIES OF WINTER WHEAT.

The climate of Ottawa being rather too severe for the regular production of good crops of winter wheat, the average yields obtained here would scarcely serve as a satisfactory guide for farmers in southern Ontario. Some recommendations in regard to varieties of winter wheat may, however, be given.

One of the best varieties in the field is Dawson's Golden Chaff (beardless). It has the disadvantage, however, of giving flour which is low in baking strength and therefore suitable for crackers, cakes, &c., but not for light bread. The gluten content of this variety is not high enough to make it quite satisfactory for the production of rolled wheat and other similar cereal products, though it is used for these purposes.

Turkey Red (bearded) yields the strongest flour, but does not as a rule give, in Ontario, as large a yield of grain per acre as some of the other sorts.

Egyptian Amber (bearded) and Tasmania Red (bearded) give good yields of grain and produce very good flour for bread making.

Imperial Amber (bearded) is another variety which can also be recommended both for its high yield and the very fair strength of its flour.

EMMER AND SPELT.

The plots of Emmer and Spelt were sown on May 13, the seed being used at the rate of about 120 pounds (or four bushels by measure) to the acre. The soil was a loam of medium character.

Common Emmer (often incorrectly called 'Speltz') is one of the best varieties. being less coarse and containing a larger proportion of kernel than most of the other sorts.

EMMER AND SPELT.—TEST OF VARIETIES.

Number.	Name of Variety.	Date of Ripening.	No. of Days Maturing.	Average length of Straw, including Head.	Strength of Straw on a Scale of 10 points.	Average length of Head.	Yield per Acre.	Weight per measured bushel after cleaning.	Rusted.
				Inches.		In.	Lbs.	Lbs.	
1	Common Emmer. . .	Aug. 20.	99	44	8	2	3,090	36	Slightly.
2	Double Emmer........	" 20.	99	44	7	$1\frac{3}{4}$	2,520	27	"
3	9 K 2..................	" 20.	99	40	7	2	2,340	$28\frac{1}{4}$	"
4	Red Emmer............	" 30.	109	50	8	$3\frac{1}{4}$	2,250	33	"
5	9 J 3	" 16.	95	46	4	$3\frac{3}{4}$	2,100	$32\frac{1}{2}$	Considerably.
6	White Spelt..........	" 29	108	48	8	5	1,830	$24\frac{1}{4}$	"
7	Red Spelt..	" 30.	109	48	8	4	1,800	$23\frac{3}{4}$	"
8	Smooth Spelt...... ..	" 26.	105	43	10	5	1,740	$24\frac{1}{4}$	Badly.

The average yield of the 8 plots was 2,209 lbs. per acre.

OATS.

STOOLING OF OATS.

A good deal has been written during the past two years about stooling and non-stooling varieties of oats, most of the assertions made appearing to be founded rather on the desires of the writers than on ascertained facts. An experiment with several varieties was carried out last season for the purpose of gaining some information as to the habits of the different varieties in this respect. The seeds were put in (May 12) 4 inches apart each way in small blocks, each block being of the same size and having the same numbers of inside and outside places. When the plants were mature, the number of stalks produced by each was counted, omitting those very few stalks, which were sometimes found, which were only a few inches long, too short to be of value if harvested by ordinary field methods.

In the following table the average number of stalks per plant is given, the varieties being arranged according to the number of stalks produced. The average number of stalks from the inside plants alone is also given. The outside plants always produced more than twice as many stalks as those inside. The number of outside plants was too small, however, to furnish trustworthy averages for themselves alone.

STOOLING OF OATS.

Variety.	Average number of stalks per plant.	Average number of stalks on each inside plant.
Sixty Day White	4·3	2·9
Daubeney Selected	3·7	2·4
Garton's Abundance, imported seed	2·7	2·0
Banner B	2·7	1·5
Garton's Abundance, grown 5 years at Ottawa	2·6	1·9
Golden Beauty	2·5	1·7
Swedish Ligowo	2·5	1·7
White Giant	2·5	1·5
Golden Giant	2·4	1·6
Thousand Dollar	2·4	1·6
Pioneer	2·3	1·7
Victory	2·3	1·5
Swedish Select	2·3	1·3
Tartar King	1·9	1·2
Wide Awake	1·8	1·2
Storm King	1·6	1·1

While the conclusions drawn from one such series of tests should not be considered as necessarily true for all conditions of soil, weather, &c., the above table allows some interesting deductions.

It is evident that the short, early-ripening varieties tend to produce a large number of stalks per plant. This is especially true of Sixty Day White, which is remarkably early and produces short, light straw. Among what may be called the standard varieties, it is interesting to notice that Garton's Abundance, said to be a non-stooling sort, produced an exceptionally large number of stalks—almost exactly the same number as Banner. Furthermore, the plants from imported seed of Abundance produced rather more stalks than those grown from seed obtained from the fifth crop in this country. This also is quite contrary to the assertions commonly made.

Some of the English varieties, particularly Storm King and Tartar King, produced a very small number of stalks per plant, and may, therefore, be regarded as essentially non-stooling varieties, under ordinary field conditions.

How far one is justified in regulating the rate of seeding according to the stooling properties of the varieties is a question not easily settled. It is evident that the root system necessary to support an average stalk of Storm King must be much larger and must be allowed more room for development than would be required by the roots for a stalk of Sixty Day White. To conclude from the above table that about 2½ times more seeds of Storm King than of Sixty Day White should be sown in the same area of ground would certainly be extremely unwise. The question is much too complicated to be dealt with in that way, and is one for experiment rather than argument.

Experiments have shown that, in the climate of Ottawa, the proper quantity of Banner oats to sow is 2 or 2½ bushels per acre. Other varieties have not yet been thoroughly tested in this regard.

Victory.—The new Swedish oat, Victory, produced at the experiment station at Svalöf, was received two years ago through the courtesy of the United States Department of Agriculture. The first season it was grown in a very small plot, but in 1909 there was sufficient seed for a plot of the usual size. This is a promising white oat with an open head and good habit of growth. It will be noticed that it stands high in the list, for yield, this year.

Early Ripe.—The very early variety Early Ripe has been temporarily withdrawn from the regular test plots as some selections of uniform type are being propagated from it.

Sixty Day White.—This variety is a selection made by the Cerealist from the Sixty Day oat. It is extraordinarily early, perhaps a little earlier than the original mixed Sixty Day, but will usually require eighty days or more to mature in the climate of Ottawa if sown reasonably early. It is not a variety that can be recommended for general purposes on account of its small kernel, very short straw and extreme susceptibility to loose smut. It may, however, be valuable for special uses.

Test Plots.—The oat plots could not be sown until May 18, too late for the growing of a large crop. The seed was used at the rate of about two bushels per acre for most varieties, but in greater quantities whenever the oats were of unusually large size. The soil was a loam of somewhat variable character.

Some of the varieties of less importance have been dropped from the list since last year.

The yield per acre is expressed in pounds and also in 'bushels' of 34 pounds.

*Varieties and selected strains produced at the Central Experimental Farm are marked with an asterisk.

OATS.—TEST OF VARIETIES.

Number.	Name of Variety.	Date of Ripening.	No. of Days Maturing.	Average Length of Straw including head.	Strength of Straw on a scale of 10 points.	Average Length of Head.	Yield per Acre.	Yield per Acre.		Weight per measured bushel after cleaning.	Rusted.
				Inches.		Inch.	Lbs.	Bush.	Lbs.	Lbs.	
1	Thousand Dollar......	Aug. 14.	88	48	5	7	2,280	67	2	30½	Considerably.
2	Irish Victor	" 19.	93	47	9	8	2,250	66	6	31	"
3	Victory	" 17.	91	44	10	7	2,250	66	6	33	Badly.
4	Swedish Ligowo	" 14.	88	45	9	7¼	2,190	64	14	31	Considerably.
5	Improved Ligowo.....	" 17.	91	43	8	6½	2,130	62	22	30½	"
6	Kendal White*........	" 19	93	46	7	7	2,130	62	22	29¼	"
7	Milford White*.......	" 17.	91	48	7	8	2,070	60	30	32	Badly.
8	Abundance....	" 18.	92	44	10	8	2,040	60	0	29½	"
9	Lincoln...............	" 17.	91	44	8	7	2,040	60	0	29½	"
10	Wide Awake	" 16.	90	45	8	7¾	2,040	60	0	30¾	Considerably.
11	Daubeney Selected*...	" 10.	84	42	8	7½	2,010	59	4	31	Slightly.
12	Improved American...	" 18.	92	43	10	7¼	2,010	59	4	30	"
13	Pioneer	" 14	88	42	8	6¾	2,010	59	4	32¾	Considerably.
14	Banner B*............	" 14.	88	41	10	7½	1,980	58	8	30	Slightly.
15	Bergs.....	" 14.	88	38	9	7	1,980	58	8	32	Considerably.
16	Mennonite............	" 18	92	45	9	7¼	1,980	58	8	29¾	"
17	Siberian	" 18.	92	44	8	7¼	1,980	58	8	30	Badly.
18	Sixty Day White*.....	" 6.	80	36	9	6	1,980	58	8	27¾	Slightly.
19	Tartar King........	" 13.	87	44	8	7½	1,980	58	8	32	Considerably.
20	Tlola	" 11.	85	50	5	9	1,980	58	8	29	"
21	Kirsche...............	" 19.	93	45	8	8	1,950	57	12	31	Badly.
22	American Triumph....	" 14.	88	40	10	7¼	1,920	56	16	30½	Considerably.
23	White Wonder	" 10.	84	46	6	8	1,920	56	16	37¼	"
24	Black Mesdag	" 11.	85	44	6	8	1,890	55	20	31¼	"
25	Danish Island	" 18.	92	38	8	7	1,890	55	20	30	"
26	Gold Rain........ ..	" 16.	90	42	10	6½	1,830	53	28	34¾	"
27	Swedish Select........	" 13.	87	41	10	7	1,830	53	28	31	"
28	Storm King.	" 17.	91	46	6	7¼	1,800	52	32	32	"
29	Virginia White.. ..	" 16	90	45	6	6¼	1,800	52	32	30¾	"
30	Garton's Abundance..	" 14.	88	38	10	6¼	1,680	49	14	30¼	"
31	Dinauer	" 17.	91	38	9	6¾	1,620	47	22	30	Badly.
32	Golden Beauty	" 17.	91	38	9	7	1,590	46	26	29¾	"
33	White Giant Selected*	" 17	91	40	10	7½	1,560	45	30	31	Considerably.
34	Twentieth Century....	" 14.	88	45	9	7½	1,500	44	4	30½	"
35	Excelsior.............	" 14.	88	34	10	6½	1,320	38	28	34½	"

The average yield of the 35 plots was 1,926 lbs. (56 bush. 22 lbs.) per acre.

MOST PRODUCTIVE VARIETIES OF OATS.

Among the most productive kinds of oats, the following white varieties deserve special mention: Thousand Dollar, Twentieth Century, Improved American, White Giant, Banner, Garton's Abundance and Danish Island. One or more of these kinds can be obtained from any good seedsman. Gold Rain is a very productive yellow oat. Among black oats, the English varieties Pioneer and Excelsior have given the best returns on the Central Farm during the past few years, but they have not proved so productive as the best white kinds.

EARLIEST VARIETIES OF OATS.

The varieties called Sixty Day and Early Ripe are extremely early in ripening, but cannot be recommended for general purposes, though they may be useful in certain special cases.

Somewhat less early, but probably more satisfactory as a rule, are Daubeney and Tartar King. These oats are obtainable in commerce, but farmers will usually find some of the later and more productive varieties to be, on the whole, more profitable.

SIX-ROW BARLEY.

The plots were sown on May 19, the seed being used at the rate of about two bushels to the acre. The soil was a rather light loam.

The yield per acre is expressed in pounds and also in 'bushels' of 48 pounds.

* Varieties and selected strains produced at the Central Experimental Farm are marked with an asterisk.

SIX-ROW BARLEY.—TEST OF VARIETIES.

Number.	Name of Variety.	Date of Ripening.		No. of Days Maturing.	Average Length of Straw including head.	Strength of Straw on a scale of ten points.	Average Length of Head.	Yield per Acre.	Yield per Acre.		Weight per measured bushel after cleaning.	Rusted.
				·	Inches.		Inch.	Lbs.	Bush.	Lbs.	Lbs.	
1	Claude*	Aug.	11	84	41	10	3¼	3,060	63	36	45¼	Slightly.
2	Albert*	"	11	84	40	10	3½	3,000	62	24	45½	"
3	Manchurian A.*	"	11	84	42	10	3¼	3,000	62	24	45½	"
4	Odessa	"	15	88	40	10	3	2,970	61	42	44	"
5	Oderbruch	"	11	84	42	10	3	2,910	60	30	47	"
6	Nugent*	"	10	83	41	10	3¼	2,820	58	36	46½	"
7	Mandscheuri	"	10	83	40	10	3	2,520	52	24	45½	"
8	Mansfield*	"	12	85	40	8	2¾	2,490	51	42	46	"
9	Mensury	"	10	83	38	10	3	2,190	45	30	45½	"
10	Black Japan	"	10	83	25	10	2	1,950	40	30	43¼	Considerably.
11	Trooper*	"	17	90	34	10	3	1,950	40	30	45	Slightly.
12	Yale*	"	13	86	40	10	2½	1,950	40	30	47¾	"
13	Bere	"	9	82	35	9	3	1,920	40	—	43	"
14	Eclipse	"	17	90	32	10	3	1,860	38	36	45½	Considerably.
15	Escourgeon	"	9	82	33	9	2¾	1,830	38	6	43¾	Slightly.
16	Stella*	"	17	90	32	10	3¼	1,680	35	—	45½	"
17	Small Blue Naked	"	15	88	30	8	2¾	1,650	34	18	51¼	"

The average yield of the 17 plots was 2,338 lbs. (48 bush. 34 lbs.) per acre.

MOST PRODUCTIVE VARIETIES OF SIX-ROW BARLEY.

Among the most productive sorts which have been tested for several years at this Farm are Mensury, Odessa, Nugent and Mandscheuri. Mensury and Odessa are obtainable from most seedsmen in Canada. The average yield of Mandscheuri for

the past five years has been greater than that of Mensury, but less than that of Nugent. A selected strain of Mensury, which is being grown under the name of Manchurian A, has surpassed the Mandscheuri in average yield for the past four years. Further tests for at least one year will be made before reaching any decision as to the relative values of these barleys.

EARLIEST VARIETIES OF SIX-ROW BARLEY.

The differences in earliness among the varieties of six-row barley are not very striking. Among the earliest sorts are Mensury and Odessa.

BEARDLESS SIX-ROW BARLEY.

Champion is the most productive variety of beardless barley that has been grown here. It ripens early, but usually gives a poor yield and is not to be recommended. It is obtainable in commerce.

HULLESS SIX-ROW BARLEY.

The most productive variety of hulless six-row barley which has been tested at this farm is Hulless Black. This is a bearded sort and can be obtained in commerce. It ripens early, but has weak straw and gives a small yield.

TWO-ROW BARLEY.

The plots were sown on May 20. The seed was used at the rate of ab… t two bushels to the acre. The soil was a loam of medium character.

The yield per acre is expressed in pounds and also in 'bushels' of 48 pounds.

* Varieties and selected strains produced at the Central Experimental Farm are marked with an asterisk.

TWO-ROW BARLEY.—TEST OF VARIETIES.

Number.	Name of Variety.	Date of Ripening.		No. of Days Maturing.	Average Length of Straw including head.	Strength of Straw on a scale of ten points.	Average Length of Head.	Yield per Acre.	Yield per Acre.		Weight per measured bushel after cleaning.	Rusted.
					Inches.		Inch.	Lbs.	Bush.	Lbs.	Lbs.	
1	Early Chevalier*	Aug.	9	81	40	7	3¾	2,610	54	18	47	Slightly.
2	Caucasian Hulless.....	"	9	81	27	5	3¼	2,520	52	24	58½	"
3	Black Two-row.......	"	20	92	35	8	3½	2,490	51	42	46	Badly.
4	Beaver*..........	"	11	83	45	10	4½	2,400	50	—	45½	Slightly.
5	Danish Chevalier.....	"	18	90	46	10	4½	2,400	50	—	46	Considerably.
6	Clifford*..........	"	11	83	43	8	3¾	2,370	49	18	47½	Slightly.
7	French Chevalier......	"	13	85	43	8	3¼	2,310	48	6	48	"
8	Canadian Thorpe.....	"	18	90	38	10	3¼	2,160	45	—	44¾	Considerably.
9	Gordon*..............	"	12	84	42	8	2¾	2,160	45	—	46½	"
10	Standwell........	"	18	90	40	7	3½	2,100	43	36	47	"
11	Brewer's Favourite....	"	20	92	44	9	3¾	2,040	42	24	45½	"
12	Princess	"	23	95	35	4	4	1,920	40	—	46	"
13	Hannchen..	"	20	92	35	8	3½	1,890	39	18	45½	"
14	Archer Chevalier......	"	23	95	35	9	4	1,830	38	6	45¼	"
15	Invincible.....	"	25	97	38	8	3	1,680	35	—	46	"
16	Primus...............	"	26	98	40	8	3½	1,680	35	—	48	"
17	Swan's Neck.........	"	29	92	37	8	3	1,680	35	—	46	Badly.
18	Leader...............	"	25	97	40	5	2½	1,680	35	—	45	Considerably.
19	Jarvis*...............	"	24	96	46	8	4¼	1,650	34	18	46½	"
20	Old Irish...........	"	25	97	36	8	4	1,650	34	18	45½	"
21	Hofbrau..........	"	24	96	37	3	4¼	1,620	33	36	46	"
22	Swedish Chevalier	"	24	96	32	8	4	1,530	31	42	47	"
23	Jewel...............	"	25	97	37	5	3¾	1,290	26	42	43½	Badly.

The average yield of the 23 plots was 1985 lbs. (41 bush. 17 lbs.) per acre.

MOST PRODUCTIVE VARIETIES OF TWO-ROW BARLEY.

The following varieties are among the most productive: Hannchen (a Swedish selection of the famous Hanna barley), Swan's Neck, Standwell, Clifford, Canadian Thorpe, Beaver and the different strains of Chevalier.

EARLIEST VARIETIES OF TWO-ROW BARLEY.

Among the earliest sorts are Hauuchen, Beaver, Clifford and some strains of Chevalier.

BEARDLESS AND HULLESS TWO-ROW BARLEY.

The varieties of beardless and of hulless two-row barley which have been tested at Ottawa have not, as a rule, shown sufficient strength of straw to make them profitable sorts for farmers to cultivate. The variety called Caucasian Hulless, which has now been tested for three years, has given good yields, but it cannot be recommended without further trial, as the straw has shown decided indications of weakness.

PEAS.

The plots of peas were sown on May 15, the seed being used at the rate of two or three bushels to the acre, according to the size of the pea. The soil was a loam of medium character.

The yield per acre is expressed in pounds and also in 'bushels' of 60 pounds.

* Varieties and selected strains produced at the Central Experimental Farm are marked with an asterisk.

PEAS.—TEST OF VARIETIES.

Number.	Name of Variety.	Date of Ripening.	No. of Days Maturing.	Character of Growth.	Average Length of Straw.	Average Length of Pod.	Yield per acre.	Yield per Acre.		Weight per Measured Bushel after Cleaning.	Size of Pea.
					Inches.	In.	Lbs.	Bush.	Lbs.	Lbs.	
1	Arthur Selected*......	Aug. 17.	94	Strong....	53	2¼	2760	46	..	64¼	Medium.....
2	Prussian Blue.........	" 23.	100	" ...	60	2¼	2700	45	..	63	" .....
3	Chancellor	" 23.	100	" ...	65	2	2610	43	30	62½	Small ....
4	English Grey..........	" 30.	107	" ...	70	2½	2580	43	..	62	Medium.....
5	Mackay*...........	" 26.	103	" ...	60	2¼	2550	42	30	62	" .....
6	Prince*..............	" 26.	103	" ...	60	2½	2550	42	30	63	Large......
7	White Marrowfat......	" 29.	106	Very str'g.	75	2½	2520	42	..	63½	" ....
8	Picton*	" 26.	103	Strong...	65	2½	2430	40	30	62	" ....
9	Victoria*.	" 29.	106	" ...	70	2¼	2430	40	30	64	Medium.....
10	Wisconsin Blue.......	" 29.	106	" ...	65	2	2400	40	..	64	" .....
11	Paragon*...........	" 26.	103	" ...	65	2¼	2240	39	..	63	" ....
12	Gregory*............	" 31.	108	Very str'g.	75	2¼	2310	38	30	63½	" .....
13	Golden Vine..........	" 29	106	Strong ..	70	2	2280	38	..	64½	Small ......
14	Canadian Beauty	" 30	107	Very str'g.	80	2¼	2160	36	..	62	Large ....
15	Early Britain........	" 30.	107	" .	75	2½	2160	36	.	61¼	Medium.....
16	Daniel O'Rourke	" 26.	103	Strong ...	70	2¼	2130	35	30	63¾	Small ....
17	Zulu	" 25.	102	" ...	70	2½	2100	35	..	60	Large.......
18	Black-eye Marrowfat..	" 31.	108	Very str'g.	75	2½	2010	33	30	63	" ....

The average yield of the 18 plots was 2,390 lbs. (39 bush. 50 lbs.) per acre.

MOST PRODUCTIVE VARIETIES OF PEAS.

Prussian Blue, Chancellor, Arthur and Golden Vine can be recommended as good, productive varieties of peas. Golden Vine has not done so well as usual during the last few years, but it is a variety which can usually be depended upon. One or more of the varieties here mentioned can be obtained from almost any seedsman.

EARLIEST VARIETIES OF PEAS.

Arthur, Chancellor and Prussian Blue are among the earliest sorts.

SPRING RYE.

The plots of Spring Rye were sown on May 13, the seed being used at the rate of about 1½ bushels to the acre. The soil was a rather light loam.

The yield per acre is expressed in pounds and also in 'bushels' of 56 pounds.

SPRING RYE.—TEST OF VARIETIES.

Number.	Name of Variety.	Date of Ripening.	No. of Days Maturing.	Average Length of Straw, including Head.	Strength of Straw on a Scale of 10 points.	Average Length of Head.	Yield per Acre.	Yield per Acre.		Weight per Measured Bushel after Cleaning.	Rusted.
				Inches.		In.	Lbs.	Bush.	Lbs.	Lbs.	
1	Common	Aug. 13.	92	57	7	3¼	2,460	43	52	56¼	Slightly.
2	Ottawa Select	" 13.	92	58	8	3½	2,280	40	40	55¾	"

The average yield of the two varieties was 2,370 lbs. (42 bush. 18 lbs.) per acre.

WINTER RYE.

Three plots of winter rye were sown on August 25, 1908, the seed being used at the rate of about 1½ bushels to the acre. The rye made fair growth in the autumn and stood the winter well. The soil was a rather heavy loam.

The yield per acre is expressed in pounds and also in 'bushels' of 56 pounds.

WINTER RYE.—TEST OF VARIETIES.

Number.	Name of Variety.	Date of Ripening.	No. of Days Maturing.	Average Length of Straw, including Head.	Strength of Straw on a Scale of 10 points.	Average Length of Head.	Yield per Acre.	Yield per Acre.		Weight per Measured Bushel after Cleaning.	Rusted.
				Inches.		In.	Lbs.	Bush.	Lbs.	Lbs.	
1	Mammoth White	July 26.	335	70	8	4	3,300	58	52	59	Slightly.
2	Thousandfold	" 26.	335	65	8	3¾	3,060	54	36	58	"
3	Dominion	" 27.	336	65	9	4¼	2,880	51	24	58½	"

The average yield of the three varieties was 3,080 lbs. (55 bush.) per acre.

FIELD BEANS.

Four plots of field beans, one-sixtieth of an acre each, were sown on May 25. The soil was a sandy loam. Only one of the varieties ripened satisfactorily.

The yield per acre is expressed in pounds and also in 'bushels' of 60 pounds.

FIELD BEANS.—TEST OF VARIETIES.

Number.	Name of Variety.	Distance between Rows.	Date of Ripening.	Number of Days Maturing.	Average Length of Plant.	Average Length of Pod.	Yield per Acre.	Yield per Acre.		Weight per Measured Bushel after Cleaning.
		Inches.		Days.	Inches.	Inches.	Lbs.	Bush.	Lbs.	Lbs.
1	White Field Selected..	20	....	115	48	$4\frac{1}{4}$	2,700	45	..	68
2	Norwegian Brown Selected...	16	Aug. 23..	90	12	$4\frac{1}{2}$	2,400	40	..	62
3	Marrowfat Selected...	20	... .	98	35	$3\frac{1}{2}$	1,950	32	30	$67\frac{1}{2}$
4	California Pea Selected	16	....	98	20	$3\frac{3}{4}$	1,770	29	30	$67\frac{1}{2}$

The average yield of the four varieties was 2,205 lbs. (36 bush. 45 lbs.) per acre.

FLAX.

The commercial kinds of flax which have been tested in the plots for some years were not of uniform character. It seemed necessary in order to obtain results of definite value to produce uniform types by selection. Several specially promising plants were therefore selected from each plot and from each plant a pure strain was produced. Only these selected strains were grown in the plots last season, but as there was not sufficient seed in any case to sow a plot of the regular size, no report of the yields is made. Other particulars in regard to the best of these new selections will be found in the following table. In addition to the field characters (which are given for the varieties grown under field conditions) determination of the weight of 1,000 seeds and of the oil and protein content were made by the Chemical Division, since the composition of the seed is a matter of considerable importance in estimating the relative values of different varieties and strains. These particulars are given in the last three columns of the table. The varieties are arranged in the table according to their oil content.

Those varieties which were grown under field conditions were sown on May 25, the seed being used at the rate of 60 pounds to the acre. The soil was a sandy loam.

Number.	Variety.	Date of Ripening.	No. of Days Maturing.	Average Length of Plants.	Weight per Measured Bushel after Cleaning.	Weight of 1,000 seeds	Protein (N x 6·25) per cent.	Oil Per Cent.
						Grammes.		
1	La Plata A	Aug. 31	98	25	53	8·854	20·25	42·20
2	" C	" 26	93	26	53½	5·975	21·94	40·82
3	Novarossick B	" 26	93	26	53½	5·511	22·12	39·94
4	La Plata B	" 26	93	24	53½	7·978	21·31	39·76
5	Yellow Seed C					4·501	25·31	38·26
6	" A					4·322	25·75	38·16
7	White Flowering B	Aug. 13	80	28	55½	4·732	23·75	37·85
8	Yellow Seed B					4·239	26·25	37·02
9	White Flowering A	Aug. 13	80	28	55¼	5·159	19·06	36·80
10	Riga B					4·542	27·25	36·70
11	" A					4·254	25·81	36·25
12	Common S	Aug. 19	86	41	56	4·156	27·00	36·01
13	" B	" 13	80	39	56	4·442	26·69	35·77
14	Russian A	" 10	77	32	55¼	4·365	26·06	35·74
15	Common D					3·904	24·00	35·64
16	Russian B	Aug. 10	77	36	55½	4·385	27·43	35·35
17	Riga C					3·912	25·25	35·35
18	Common R	Aug. 19	86	40	56	4·333	27·37	35·28
19	" C					4·245	24·19	34·62
20	" A	Aug. 13	80	39	55¾	4·493	27·56	34·50

FIELD ROOTS.

The advantage of late pulling for field roots having been clearly proved by the experience of several years, comparative tests, by pulling on two different dates about two weeks apart, have been discontinued. All the roots were harvested at the one time but the harvesting was left until quite late, so as to enable the roots to make as large a growth as possible.

The yield per acre of the field roots is calculated from the weight of the crop gathered from one-hundredth of an acre.

The soil on which the field roots were grown was a heavy loam.

It is probable that in some instances varieties which are mentioned in these tables under different names are identical in all essential respects.

In Canada the ton contains 2,000 pounds.

TURNIPS.

Two sowings were made of each variety, the first on June 2 and the second on June 16. The seed was used at the rate of about 4 pounds per acre. Before sowing, the land was made up in drills 2 feet apart and rolled with a heavy land roller, which flattened the drills nearly one-half, leaving a firm seed bed. When the young plants were about 3 inches high they were thinned out, leaving them about 7 inches apart in the rows.

The roots were pulled on October 23.

TURNIPS.—TEST OF VARIETIES.

Number.	Name of Variety.	Yield per acre from 1st Sowing.		Yield per acre from 2nd Sowing.	
		Tons.	Lbs.	Tons.	Lbs.
1	Good Luck	48	1,700	30	600
2	Halewood's Bronze Top	31	500	26	800
3	Magnum Bonum	31	500	27	200
4	Jumbo	31	400	30	400
5	Hartley's Bronze	29	1,600	27	——
6	Bangholm Selected	28	1,100	23	1,600
7	Kangaroo	27	1,300	26	1,900
8	Carter's Elephant	27	100	25	200
9	Hall's Westbury	26	100	25	900
10	Mammoth Clyde	25	1,400	24	——
11	Perfection Swede	22	400	20	800
12	Skirvings	21	1,400	19	1,900

The average yield from the first sowing was 29 tons 542 lbs. per acre.
The average yield from the second sowing was 25 tons 1,108 lbs. per acre.

MANGELS.

Two sowings were made of each variety, the first on June 2 and the second on June 16. The seed was used at the rate of about 6 pounds per acre. Before sowing, the land was made up in drills 2 feet apart and rolled with a heavy land roller to make a firm seed bed. When the young plants were about 3 inches high they were thinned out, leaving them about 7 inches apart in the rows. The roots were pulled October 21.

MANGELS.—TEST OF VARIETIES.

Number.	Name of Variety.	Yield per acre from 1st Sowing.		Yield per acre from 2nd Sowing.	
		Tons.	Lbs.	Tons.	Lbs.
1	Giant Yellow Intermediate	34	600	27	600
2	Mammoth Red Intermediate	33	300	25	1,400
3	Giant Yellow Globe	22	1,400	31	1,100
4	Giant Sugar (Canadian Seed)	32	1,000	31	800
5	Half Sugar White	32	900	30	400
6	Ideal (Canadian Seed)	29	1,000	28	800
7	Perfection Mammoth Long Red	29	800	19	900
8	Gate Post	27	1,600	28	1,200
9	Grimson Champion	27	1,100	25	1,200
10	Prize Mammoth Long Red	24	1,800	21	700
11	Selected Yellow Globe	22	1,800	20	——
12	Yellow Intermediate	19	900	16	1,700

The average yield from the first sowing was 28 tons 1,767 lbs. per acre.
The average yield from the second sowing was 25 tons 1,067 lbs. per acre.

CARROTS.

Two sowings were made of each variety, the first on June 2 and the second on June 16. The seed was used at the rate of about 6 pounds per acre. Before sowing, the land was made up in drills 2 feet apart and rolled with a heavy land roller to make a firm seed bed. When the young plants were about 3 inches high they were thinned out, leaving them about 5 inches apart in the rows. The roots were pulled October 22.

CARROTS.—TEST OF VARIETIES.

Number.	Name of Variety.	Yield per acre from 1st Sowing.		Yield per acre from 2nd Sowing.	
		Tons.	Lbs.	Tons.	Lbs.
1	Improved Short White	19	1,900	18	——
2	Ontario Champion	19	1,100	18	1,800
3	White Belgian	18	800	16	800
4	Mammoth White Intermediate	16	700	15	900
5	Half Long Chantenay	14	1,900	15	1,000

The average yield from the first sowing was 17 tons 1,680 lbs. per acre.
The average yield from the second sowing was 16 tons 1,700 lbs. per acre.

SUGAR BEETS.

Two sowings were made of each variety, the first on June 2 and the second on June 16. The seed was used at the rate of about 6 pounds per acre. Before sowing, the land was made up in drills 2 feet apart and rolled with a heavy land roller to make a firm seed bed. When the young plants were about 3 inches high they were thinned out, leaving them about 5 inches apart in the rows. The roots were pulled on October 21.

SUGAR BEETS.—TEST OF VARIETIES.

Number.	Name of Variety.	Yield per acre from 1st Sowing.		Yield per acre from 2nd Sowing.	
		Tons.	Lbs.	Tons.	Lbs.
1	Vilmorin's Improved	15	1,600	13	200
2	French Very Rich	15	1,000	13	1,800
3	Klein Wanzleben	14	1,900	11	400

The average yield from the first sowing was 15 tons 833 lbs. per acre.
The average yield from the second sowing was 12 tons 1,467 lbs. per acre.

INDIAN CORN.

The corn was sown with the seed drill in rows 35 inches apart, and was also sown in hills 35 inches apart each way. When the plants were about 6 inches high they were thinned out, leaving them from 6 to 8 inches apart in the rows, and leaving four or five plants in each hill. The seed was sown June 2, and the corn was cut green for

ensilage September 17. The yield has been calculated from the weight of crop cut from two rows, each 66 feet long. The soil was a rather heavy loam.

For the making of ensilage the corn should be cut when the kernels are in the late milk or doughy stage; but the summer at Ottawa is not always warm enough to bring the later varieties to this stage of maturity before it is necessary to cut the crop to avoid serious frost.

In Canada the ton contains 2,000 pounds.

INDIAN CORN.—TEST OF VARIETIES.

Number.	Name of Variety.	Character of growth.	Height.	Leafiness.	Condition when cut.	Weight per Acre grown in Rows.		Weight per Acre grown in Hills.	
			Inches.			Tons.	Lbs.	Tons.	Lbs.
1	Superior Fodder..	Very Strong..	100	Very leafy..	Early milk.	16	1,000	17	100
2	Eureka..................	" ..	95	Leafy	" ..	16	450	17	1,310
3	Wood's Northern Dent...	" ..	95	Very leafy..	" ..	16	340	15	1,900
4	Selected Leaming	Strong	90	" ..	" ..	14	1,700	17	980
5	Early Mastodon	"	90	" ..	" ..	14	1,260	13	1,720
6	Salzer's All Gold.	"	90	" ..	" ..	14	710	15	30
7	Champion White Pearl...	" .. .	85	Leafy	" ..	13	1,500	14	490
8	White Cap Yellow Dent.	Medium ..	85	Very leafy..	" ..	13	950	15	1,240
9	Compton's Early...... ...	"	80	" ..	Doughy	12	1,960	13	730
10	Mammoth Cuban.... ...	Strong	90	Leafy	Early milk..	12	1,850	15	1,130
11	Angel of Midnight.......	Medium......	85	" ..	Late " .	12	1,080	11	1,320
12	North Dakota White.....	"	80	Fairly leafy.	Early " .	12	750	12	1,850
13	Longfellow	"	85	Leafy	Doughy	12	420	13	730
14	Davidson.	"	65	" ..	Ripe	8	830	8	500

The average yield from the rows was 13 tons 1,343 lbs. per acre.
The average yield from the hills was 14 tons 852 lbs. per acre.

INDIAN CORN SOWN AT DIFFERENT DISTANCES.

Three varieties were chosen for this test: Champion White Pearl, Selected Leaming and Longfellow. The seed was sown June 2, and the corn was cut for ensilage September 17. Sixteen rows of each variety were sown; that is, four rows at each of the distances mentioned, and the yield per acre has been calculated from the weight of crop obtained from the two inner rows in each case. The length of the portions of the rows cut for weighing was 66 feet.

Name of Variety.	Distance between the rows.	Character of Growth.	Height.	Condition when cut.	Weight per Acre.	
	Inches.		Inches.		Tons.	Lbs.
Champion White Pearl...........	21	Strong..	95	Early milk ...	19	367
" "	28	Very strong ..	115	"	21	1,005
" "	35	" ..	115	"	13	1,500
" "	42	" .	125	" . . .	21	1,052
Selected Leaming......................	21	Strong........	95	"	17	209
" "	28	Very strong ..	105	"	20	1,172
" "	35	" ..	105	"	14	1,700
" "	42	" ..	125	"	21	1,052
Longfellow..	21	Strong........	90	Doughy	17	1,910
"	28	"	95	"	17	1,955
"	35	"	95	"	12	420
"	42	"	100	"	18	190

FIELD PLOTS OF POTATOES.

As the experimental plots of field roots and fodder corn do not occupy the whole of the field in which they are placed, the remaining space is usually filled with potatoes, such varieties being grown as will be of service in the annual distribution of samples from this Farm. The area devoted to the different varieties varies considerably. The past season most of the plots were from one to one and a half acres in area.

Gold Coin and Rochester Rose were planted from the 6th to the 12th of May. The remaining varieties were put in from June 3 to June 5. The potatoes were harvested from October 7 to 13.

The yield per acre (of sound potatoes only) is expressed in pounds and also in 'bushels' of 60 pounds.

FIELD PLOTS OF POTATOES.

Number.	Variety.	Time of Maturing.	Colour.	Yield per Acre.	Yield per Acre.	
				Lbs.	Bush.	Lbs.
1	Carman No. 1	Mid-season to late	White	23,930	398	50
2	Rochester Rose	Very early	Pink	23,088	384	48
3	Money Maker	Medium	White	21,689	361	29
4	Gold Coin	Mid-season to late	"	19,614	326	54
5	Irish Cobbler	Early	"	15,814	263	34
6	Emigrant	"	Pink	14,350	239	10
7	Dooley	Mid-season to late	White	7,474	124	34

REPORT OF THE CHEMIST.

FRANK T. SHUTT, M.A., F.I.C., F.C.S., F.R.S.C.

OTTAWA, April 1, 1910.

Dr. WILLIAM SAUNDERS, C.M.G.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith the twenty-third annual report of the Chemical Division of the Experimental Farms.

The past year has seen a very considerable increase in the work of this Division as regards analyses in connection with investigations carried on at the various Experimental Farms, in the examination of samples of an agricultural nature sent in by farmers and in the matter of correspondence. In view of this and the further fact that the staff has recently suffered through the resignation of two of the assistant chemists, many of the researches in hand could not be completed in time for insertion in this report, which. therefore, it must be understood, presents but a part of the work of the year. The more important investigations, however, that had reached a satisfactory stage for reporting, together with certain matters, the publication of which could not well be deferred, have been treated in the following pages.

Wheat and Flour.—The investigation commenced some years ago to ascertain the influence of environment on the composition of wheat has been continued and certain very striking results obtained. The experiments described were conducted on irrigated and non-irrigated lands at Lethbridge, Alta. With the same seed sown on both areas the product from the latter was the richer in protein by 4·39 per cent. The evidence, therefore, is strongly in accord with that of previous seasons, in showing that the gluten-content of wheat is markedly affected by the abundance or otherwise of moisture present in the soil during the development of the grain.

A study has been made of the composition of wheat straw from the flowering stage of the plant to that of ripeness. The results are of interest in throwing light upon certain points in the nutrition of the wheat plant and in affording information respecting the feeding value of straw cut at various stages of growth.

A preliminary study on the character of bleached flour has been made and data obtained upon the following important points:—(a) the amount of nitrite-reacting material in freshly bleached flour; (b) the moisture, ash and fat content of bleached flour; (c) the influence of bleaching on the nitrogen compounds of flour; (d) the presence of nitrite nitrogen in bread from bleached and unbleached flour; (e) the water absorptive capacity of bleached and unbleached flour; (f) the action of light and air as bleaching agents, and (g) the absorption of nitrite nitrogen by flour when exposed to the atmosphere.

Flax.—The analysis of twenty samples of flax, representing as many distinct strains, grown on the Experimental Farms in 1909, has been made. The data show

that marked differences in oil and protein content exist. There seems a strong probability that flax seed upon the market is by no means uniform in composition.

Inoculation for Legumes.—Pot and plot trials have been made during the season of 1909 with Hiltner's Nitragin as prepared by the Dr. Reiche Nitragin Company, Milwaukee, Wis., U.S.A., employing cultures for Red Clover, Alfalfa and Peas. Though the soil used was not one that had borne a leguminous crop for a number of years—at least nine—no marked advantage, speaking generally, followed the use of the cultures. This is perhaps explained by the presence of the nitrogen-assimilating organisms, as made evident by the fact that the roots of the plants in the uninoculated soil were found to be plentifully supplied with nodules.

Field Roots.—As for a number of years past, the nutritive value of the different varieties of mangels, turnips and carrots, as grown on the Experimental Farm, Ottawa, has been determined. The investigation is of interest, in addition to its main purpose, in bringing out the influence of season upon the composition of the roots.

Heredity as a factor in determining the composition of mangels has again been investigated, using the well known varieties Gate Post and Giant Yellow Globe. The season of 1909 is the tenth that this research has been prosecuted.

Sugar Beets for Factory Purposes.—The three leading varieties—Vilmorin's Improved, Klein Wanzleben and Trés Riche—as grown on the Dominion Experimental Farms, have again been submitted to analysis. On the whole, the results are most satisfactory, indicating that beets of a high sugar content and possessing an excellent degree of purity can be grown at widely distant points in the Dominion. The season was a favourable one for this crop at nearly all the Experimental Farms.

The Moisture-content of Packed and Unpacked Soils.—In this preliminary examination we have endeavoured to ascertain the value of subsurface packing as a means of conserving moisture. The experiments were conducted on areas at the Experimental Farm, Lacombe, northern Alberta. The results, though not to be considered as of a conclusive character, have not shown any material benefit from the use of the subsurface packer.

The Fertilizing Value of Rain and Snow.—The third year's work in this investigation is now reported. Seventy-five samples of rain and thirty-six of snow have been analysed. The total amount of nitrogen furnished per acre for the twelve months ending February 28, 1910, is 6·87 pounds and stands practically midway between the amounts recorded for the two previous years.

Well Waters from Farm Homesteads.—During the year 79 samples of water have been submitted to complete sanitary chemical analysis. Of these 31 have been reported as wholesome and safe for drinking purposes; 11 as seriously polluted and entirely unfit for domestic use; 26 as suspicious and probably dangerous, and 11 as saline. This branch of our work continues to be a popular one with the agricultural public and is undoubtedly of much service in procuring good water on the Canadian farm homestead.

Samples received for Examination.—A classified list of the samples received for examination during the past year is presented in the following table:—

SAMPLES Received for Examination and Report for the Twelve Months ended March 31, 1910.

Sample.	British Columbia.	Alberta.	Saskatchewan.	Manitoba.	Ontario.	Quebec.	New Brunswick.	Nova Scotia.	Prince Edward Island.	Total.	Number still awaiting examination.
Soils	66	27	28	9	25	47	3	12	6	223	75
Mucks, muds and marls	1	1	....	....	2	1	2	6	9	22	7
Manures aud fertilizers	6	....	1	2	10	18	4	13	....	54	6
Forage plants and fodders	10	16	5	9	98	22	2	5	2	169	27
Well waters	8	8	11	6	171	22	4	5	3	238	......
Miscellaneous including dairy products, fungicides aud insecticides	11	6	10	8	149	29	4	12	3	232	39
Totals	102	58	55	34	455	139	19	53	23	938	154

While every effort is made to furnish information respecting the samples of a purely agricultural nature, we wish to advise our readers that it does not come within our province to analyse and report upon samples of commercial fertilizers. Correspondents desiring such analyses should communicate with the Inland Revenue Department, Ottawa. Nor can we undertake the assays or analyses of minerals and mineral waters. Questions relating to minerals may be addressed to the Department of Mines, Ottawa. And, lastly, we cannot make any analysis the results of which we do not consider of general value to the agricultural public. Examination in connection with suspected poisoning cases of animals is not undertaken.

Meat Inspection Division, Health of Animals Branch, Department of Agriculture.—Continuing this work a very considerable number of samples, consisting chiefly of preservatives, dye stuffs, spices and condiments and pickling solutions and compounds used in the packing house business, have been examined and reported upon. The chemical and microscopical work upon these samples has been with the view of determining their nature and purity.

Soils.—The most important work in soil analysis during the past year has been the completion of an investigation commenced a number of years ago respecting the nature and composition of certain typical prairie soils from northwestern Canada. It has been thought desirable to present these results with the practical conclusions drawn therefrom in bulletin form. The bulletin has gone to press and will shortly be available for distribution.

Papers Read before Scientific Societies.—The following are the titles of papers prepared and presented during the past year:—

'The Influence of Environment on the Composition of Wheat' (*Society of Chemical Industry*).

'Flour, the Relation of Composition to Bread-making Value' (*Seventh International Congress of Applied Chemistry*).

'Some Characteristics of Western Prairie Soils,' and 'Chemical Work on Canadian Wheat and Flour' (*British Association for the Advancement of Science*).

The Staff—Acknowledgments.—Reference has already been made to the resignation of two of the staff. Mr. H. W. Charlton, B.A.Sc., had been with us since 1899, and for a number of years past had had charge more particularly of the nitrogen

determinations and water analysis. During his term of office he proved himself an efficient analyst and one who performed the duties assigned to him with faithfulness and accuracy. In the resignation of Mr. A. G. Spencer, M.Sc., who was appointed in June, 1907, we lost a chemist of ability and one whose industry and skill in investigations had very considerably assisted in the work of the Division. It was with much regret that his resignation, made in order to accept a more lucrative position, was received.

Miss Olive Robertson has continued to discharge the clerical duties of the Division to our satisfaction and has earned our thanks for the painstaking and excellent manner in which her work has been performed.

The important post of First Assistant Chemist has been held for the past twelve years by Mr. A. T. Charron, M.A., who, in addition to the general charge of the laboratory work, has rendered most valuable assistance in the preparation of the annual report and other publications of the Division. Reference must also be made to Mr. Charron's assistance in connection with the large French correspondence of the Division and to the courses of lectures annually given by him on agricultural subjects in Quebec and other French-speaking parts of the Dominion. My hearty thanks are due him for much excellent help in the conduct of the work of the Chemical Division of the Dominion Experimental Farms.

I have the honour to be, sir,

Your obedient servant.

FRANK T. SHUTT,

Chemist, Dominion Experimental Farms.

WHEAT.

THE COMPOSITION OF THE GRAIN AS INFLUENCED BY THE SOIL MOISTURE-CONTENT.

In the prosecution of this study, we began in 1908 a series of experiments on the Experimental Farm at Lethbridge in southern Alberta, a so-called semi-arid district, to learn the influence of irrigation on the nitrogen (gluten) content of wheat. We had already noticed from our investigation in the Valley River district, northern Manitoba, that the moisture-content of the soil during the development of the kernel had a marked effect on the gluten-content of the grain. An abundance of moisture tended to the production of a plumper, more starchy grain than when the supply was merely sufficient to bring the grain to maturity. The experiments on irrigated and non-irrigated land in 1908, already referred to, showed that Red Fife on the former contained 2·67 per cent less protein than that on the drier soil; similarly with Kharkov we obtained a difference in protein-content of approximately 1·0 per cent.

The repetition of this work during the past season, 1909, has afforded results of a still more marked character, as will be seen from the following statement:—

	Protein (Nx5·7) p.c.
Red Fife.—Parent seed, grown on non-irrigated land, 1908. .	13·97
" Grown on irrigated land.	11·74
" Grown on non-irrigated land.	16·13

The difference in protein-content here observed between the wheats grown on irrigated and on non-irrigated soils, 4·39 per cent, is phenomenally large and, being in the same direction as previous results, assuredly supports, in a very emphatic manner, our contention that the amount of available moisture during the filling out of the grain affects its composition.

It is interesting to note, in passing, that the produce of the parent seed which had been grown in 1908, a somewhat wetter season than 1909, showed, on non-irrigated land, an improvement as regards protein-content in the drier season—an increase of 2·16 per cent—and a deterioration, if such it may be called, of 2·23 per cent when grown on irrigated soil.

The moisture-content of the two areas, irrigated and non-irrigated, was determined from time to time during the period when the greater development of the grain must have taken place, but we are of the opinion that more frequent collections would have yielded more conclusive results as regards the amounts of moisture available to the crops.

MOISTURE in Irrigated and Non-irrigated Soils.
(Samples collected to a depth of 14 inches).

Date of Collection. (Samples collected to a depth of 14 inches).	Irrigated.	Non-irrigated.
	p.c.	p.c.
July 16, 1909	9·62	8·50
August 1, 1909	8·19	6·20
" 25, 1909	8·16	5·99

One irrigation only was made, on July 10.

It is significant that during the above mentioned period the irrigated land lost 1·46 per cent moisture and the non-irrigated lost 2·51 per cent. Further, that while at the first collection the non-irrigated land was approximately only 1 per cent drier, it was at the time of the last collection 2·17 per cent drier than the irrigated soil. These differences expressed in percentages may appear small, but when it is remembered

that the weight of an acre of soil to a depth of 14 inches will be in the neighbourhood of 3,500,000 lbs., it follows that the apparently insignificant difference of 1 per cent becomes of moment, as it is equivalent to about 17·5 tons more water per acre available for the crop's needs.

In concluding this chapter, it is perhaps only right to state that the higher protein-content wheat, while the more valuable for mixing with soft wheats, may not necessarily yield the better flour for bread making, and, further, the yield of wheat is, as a rule, considerably higher on irrigated that an non-irrigated areas.

WHEAT STRAW AT DIFFERENT STAGES OF GROWTH.

In connection with our work on the chemistry of wheat and flour, and more particularly in relation to the investigation on the influence of environment on the composition of the grain, it was considered desirable to make a study of the composition as regards nitrogen compounds of the straw of the wheat plant at different stages from the flowering period to that of dead ripeness.

Through the kindness of the Cerealist, a portion of a large plot of the spring wheat Bishop, a cross-bred variety produced on the Central Experimental Farm, was placed at our disposal for the purpose of this investigation. In the collection of the samples the plants were cut 4 inches from the ground and the heads were immediately removed in order to prevent migration of the nutrients from the straw. In all, seven cuttings were made, the first being on July 9, 1909, when the plants were in flower, and the last on August 24, when the grain was dead ripe.

In the tabulated statement of data the following information is given: Date of collection, stage of growth when sample was taken, the proportional weights of heads and straw, the percentage of dry matter and the percentage of total and albuminoid nitrogen present in the dry matter, from which the proportion of total nitrogen in the form of albuminoid has been calculated.

Composition of Wheat Straw at Different Stages of Growth.

Laboratory No.	Date of Collection.	Designation of Sample.	In Fresh Material.					In water-free Substance		
			Heads.	Straw.	Dry matter.	Nitrogen. Total.	Nitrogen. Albuminoid.	Nitrogen. Total.	Nitrogen. Albuminoid.	Proportion in form of albuminoids.
	1909		p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.
7043	July 9	In flower.........	14·4	85·6	23·36	·404	·327	1·73	1·40	80·9
7058	" 16	Very early milk stage....	19·7	80·3	26·87	·398	·313	1·48	1·16	78·3
7073	" 26	Kernel formed; 'Dough stage'.	32·4	67·6	34·37	·399	·313	1·16	·91	78·4
7082	Aug. 3	Kernel plump; 'Late dough stage' Straw about half yellow............	41·7	58·3	39·19	·364	·294	·93	·75	80·6
7096	" 9	Ripe for harvest; Straw completely yellow.....	47·3	52·7	51·30	·277	·241	·54	·47	87·0
7111	" 14	Very ripe........	53·7	46·3	80·81	·389	·347	·48	·43	89·5
7134	" 24	Dead ripe........	58·4	41·6	85·82	·395	·335	·46	·39	84·8

Considering first the proportional weights of heads and straw, we observe that the weight of the heads increases from the beginning to the close of the collection period. The largest increase in this weight occurred between the 'early milk' and the 'dough' stages, and the next largest between the latter and the 'late dough' stage, when the kernel was quite plump. The increases in proportional weight of the heads during the latter portion of the collection period are to be attributed more especially, we may presume, to the rapid drying out of the straw.

Coming now to the purpose of the investigation proper, namely, the changes in the composition of the straw during growth and ripening, the dry matter will be seen to increase from the earliest stage of the collection, when the plant was in flower, until the grain was dead ripe. While it is impossible to say definitely at what condition of the plant feeding ceases, there can be little doubt but that the acquisition of nourishment from the soil and air must proceed until some short time after the straw begins to turn yellow; and, further, that after the straw has become completely yellow, functional activity in this direction must cease. On this assumption, therefore, the increases in the dry matter of the straw noted until, say, August 9, must largely be due to the storing up of dry matter by the plant, and that after that date the apparent increase would be mainly owing to desiccation.

The total nitrogen in the fresh straw remains practically constant until the kernel has reached the dough stage. It then declines somewhat rapidly until the grain is ready for harvesting. From this on, there is a marked increase until the grain is dead ripe. Since the percentage of dry matter in the straw increases, and, as we have seen, the percentage of nitrogen remains practically constant until the 'dough' stage of the kernel, it follows that there must be during this period a constant acquisition of nitrogen by the plant. The falling off of the nitrogen in the fresh straw apparent later, would be an indication that the migration of nitrogenous compounds to the kernel is greater than the income, or, put in other words, the grain is making a draft on the store of already accumulated nitrogen. The increase after the grain is ripe is undoubtedly due to desiccation.

Considering the total nitrogen-content of the water-free substauce, a steady decrease is to be noticed until the grain is ready for harvesting, after which it remains practically constant. From these facts, it might be argued either that the material migrating to the kernel is richer in nitrogen than that being elaborated by the plant, or that the latter becomes less and less nitrogenous as maturity approaches. The constancy of the nitrogen-content of the dry matter of the straw after the grain is ripe would indicate that migration had ceased or that the material being transferred to the kernel is of the same composition as that already in the plant. The former is in all probability the correct explanation, as at this period the straw must be practically functionally dead.

The study of the character of the nitrogen-compounds in the straw, as the plant proceeds from the flowering stage to that of complete maturity, is one of the most interesting features of this investigation. Until the late dough stage, the proportion of albuminoid to non-albuminoid nitrogen remains fairly constant. When this period has been reached and the grain begins to mature, there is a sudden, though not very large, increase in the proportion found as albuminoids. In these facts we have a strong indication of the constancy in composition of the nitrogenous material of the dry matter during, at all events, the earlier period of the grain's development, when the straw is in full functional activity. Subsequently, and as the straw loses vitality, which is indicated by it turning yellow, there is apparently a more or less rapid conversion into the albuminoid form. However, it is possible to account for this rise in the proportion of albuminoid nitrogen by the migration of soluble (non-albuminoid) nitrogen to the kernel at a time when acquisition of nitrogen has practically ceased.

From the standpoint of the farmer who wishes to know what may be the feeding value of wheat straw cut at one or other of the final stages of the grain's development,

this investigation shows that while the dry matter of the straw becomes poorer and poorer in nitrogenous compounds (both albuminoid and non-albuminoid) as the grain develops, the total amount of such nitrogen in the straw does not materially alter, by reason of the ever-increasing storage in the straw of dry matter. The practical conclusion from this is that straw cut before the grain is fully ripe differs in feeding value from that cut later, chiefly by reason of its greater digestibility rather than from the presence of any larger proportion of the more valuable nutrients. Ton for ton, undoubtedly the earlier cut straw is the more nutritious fodder, not as some suppose by the possession of a larger percentage of albuminoids, but from the greater availability of its constituents for the nourishment of the animal.

BLEACHED FLOUR.

The widespread interest in the United States at the present time in bleached flour as a wholesome article of food, pointed to the desirability of obtaining data respecting the influence of the bleaching agent commercially used—nitrogen peroxide—on the flour and the resultant bread. Consequently, in conjunction with the Cerealist, whose results will be found in his current report, a preliminary study has been made comprising the chemical and physical examinations of bleached flours and their breads.

In the first place a series of six flours, four of which had been milled in the Farm's experimental roller mill, were bleached under the supervision of the Cerealist. These, together with samples of the same flours unbleached, were submitted to examination in the laboratory, the following determinations being made: Moisture, total nitrogen, gliadin nitrogen, wet and dry gluten, the nitrogen in nitrite-reacting material and, in certain instances, the ash and the fat.

In every instance the bleached flour was the lighter in colour.

EFFECT OF BLEACHING ON THE COMPOSITION OF FLOUR.*

Laboratory No.	Description.	Moisture.	Ash.	Fat.	Total Nitrogen.	Gliadin Nitrogen.	Gluten.					Nitrite-reacting material as nitrogen.
							Wet.	Dry.	Physical Characters.			
									Resiliency.	Elasticity.	Colour.	
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.				p.p.m.
7484	Spring Wheat Flour, commercial, bleached.....	11·10	·38	1·01	2·06	·91	33·46	12·05	Good...	Fair....	Good..........	·90
7485	" " " unbleached...	11·38	·38	1·01	2·07	·94	32·63	12·01	" ...	" ...	"	·40
7486	Winter Wheat Flour, commercial, bleached.....	10·98	·49	1·19	1·65	·69	30·88	11·08	Fair....	" ...	"	.25
7487	" " " unbleached...	11·48	·50	1·16	1·62	·68	30·96	10·95	" ...	" ...	"	.09
7488	Yellow Cross Flour, bleached.................	9·58	....	....	2·18	·97	43·09	16·46	Good...	Good..	"	·20
7489	" " unbleached...............	10·54	....	....	2·14	·94	43·65	16·78	" ...	" ...	"	None.
7490	Kubanka Flour, bleached..................	9·81	....	....	2·25	·95	43·66	16·77	" ...	" ...	Slightly yellow.	Trace.
7491	" " unbleached.................	10·46	....	....	2·23	·89	43·74	16·66	" ...	" ...	"	None.
7492	Ebert Flour, bleached....................	9·77	....	....	2·27	1·13	43·81	16·55	" ...	" ...	"	·15
7493	" unbleached..................	10·54	....	....	2·25	1·09	43·48	16·28	" ..	...	"	None.
7494	Red Fife Flour, bleached....................	9·78	....	....	2·32	1·03	44·21	16·59	" ...	" ...	Good..........	·15
7495	" " unbleached..................	10·48	....	....	2·34	1·03	46·15	16·75	" ...	" ...	"	None.

* All bleached flours employed in this investigation were bleached at our special request for this research.

Moisture.—In every instance the bleached sample was the drier, the average difference in moisture-content being ·66 per cent. All these flours, except the two commercial samples, had been kept for sometime previous to the treatment (the middle of December) in paper bags under ordinary indoor conditions. The treated flours were at once rebagged and the analyses made about two weeks after bleaching. We may, therefore, safely conclude that the lower percentage of moisture in the bleached flour is to be attributed to the treatment.

From subsequent work it would appear that the differences here noted are considerably larger than those ordinarily found between bleached and unbleached samples of the same flour when examined very shortly after treatment. It is, however, true that the bleached samples have invariably proved the drier, compared with untreated flour from the same stock.

The data referred to are as follows:—

MOISTURE-CONTENT of Bleached and Unbleached Flour.

Flour.	Moisture
	per cent.
Laboratory No. 7572 S. B., bleached	12·60
" 7571 " unbleached	12·75
" 7570 R. H., bleached	12·71
" 7569 " unbleached	12·88
" 7621 F. F. bleached	13·19
" 7620 " unbleached	13 20
" 7623 P. F., bleached	12·36
" 7622 " unbleached	12·47
" 7625 B. F., bleached	11·96
" 7624 " unbleached	12·01

Ash.—As we expected, the bleaching process did not affect the ash-content. Two flours were analysed in this regard, and the bleached and unbleached of each yielded identical results.

Later in the investigation some further data on this point were obtained and these, as will be evident from the subjoined figures, confirm the above finding.

ASH-CONTENT of Bleached and Unbleached Flour.

Flour.	Ash
	per cent.
Laboratory No. 7570 R. H., bleached	0·38
" 7569 " unbleached	0·38
" 7572 S. B., bleached	0·64
" 7571 " unbleached	0·62

Fat.—The determination of fat was made on two pairs of flours only. The figures obtained show that the bleaching process does not appreciably affect the percentage of this constituent. It was observed, however, that the extracted fat of the bleached flour was invariably paler than that of the corresponding untreated flour.

Total and Gliadin Nitrogen.—The most careful scrutiny of these data does not disclose that there has been any influence on the nitrogen compounds by the bleaching

agent. Throughout the series the results of each pair (bleached and unbleached) are extremely close, certainly the differences are such as might be ascribed to experimental error.

Wet and Dry Gluten.—These physical determinations yielded nothing of diagnostic value, unless the paler colour of the gluten from the bleached flour could be so considered. Not only were the amount of wet and dry gluten appreciably the same for the unbleached and bleached samples of flour, but no differences could be discerned in their resiliency and elasticity.

Nitrogen in Nitrite-reacting Material.—The bleaching of the flours used in this research was effected by the Alsop process, in which air containing nitrogen peroxide is the bleaching agent. An outline of the operation is as follows: A current of air is made to pass between rotatory electrodes emitting flaming discharges. This so-called electrified air is conducted into a drum or agitator through which the flour is passed in such a manner as to bring it into intimate contact with the bleaching agent. The flour in passing through the agitator occupies from 8 to 15 seconds.

The determination of nitrite nitrogen was made by the Griess-Ilosvay method, a test of extreme delicacy. It is stated to permit of the detection of 'one part of nitrite-reacting substance in one thousand million parts of the material.' As some confusion has arisen among chemists in respect to the manner of stating results, it may be well to say that in this investigation the data from this method have been calculated to ***nitrogen*** and express the amounts of nitrogen present in nitrite-reacting material, in parts per million of flour. The nitrite-reacting material expressed as nitrogen, ranged in the six bleached flours of the series from traces to ·9 parts per million. It is interesting to note that in five of the six cases the quantity did not exceed ·25 p.p.m.

Later in the investigation, five other samples of bleached flour were examined and the nitrite nitrogen found ranged from traces to ·45 p.p.m. The data are as follows:—

Nitrite Nitrogen in Bleached Flours.

Flour.	Nitrite-reacting material as Nitrogen.
	p. p. m.
Laboratory No. 7570 R. H	Trace.
" " 7572 S. B	·15
" " 7621 F. F	·20
" " 7623 P. F	·45
" " 7625 B. F	·44

Summarizing this feature of the work, ten of the eleven bleached flours contained less than ·5 p.p.m. nitrite nitrogen.

The analysis of all these samples was made within three weeks of the bleaching process, so that these results should indicate the amounts present in freshly, or practically freshly, treated flour.

Coming now to the question of nitrite nitrogen in unbleached flour, the data of the first series show that no trace of nitrite-reacting material was detected in four of the six samples submitted to examination. In the other two, Laboratory Nos. 7485 and 7487, ·4 and ·09 p.p.m. were found respectively. These two samples were obtained from flours that had been kept several days unprotected in the room where bleaching was being carried on and, further, were packed in the same box when being shipped to Ottawa. To ascertain if the presence of the nitrite nitrogen noted in these two flours was the result of absorption from the atmosphere of the bleaching room or

possibly from the close association with bleached samples in transit, it was decided to obtain and submit to examination a series of flours bought on the open market, respecting which we had the assurance that they had not been subjected to the bleaching process, and, secondly, a series collected and immediately bottled from the stream of flour as it entered the agitator of the Alsop apparatus. If these flours were found to give the nitrite reaction, then it might be held that unbleached flours might normally contain nitrite-reacting material. If, on the other hand, no such action were obtained it might be concluded that the two flours, Nos. 7485 and 7487, had absorbed their nitrite nitrogen from the atmosphere of the bleaching room or of the box containing the bleached samples. As will be seen from the following data none gave the nitrite reaction.

NITRITE Nitrogen in Unbleached Flours.

Flour.	Nitrite-reacting material as Nitrogen.
Series 1. Commercial.	p. p. m.
Laboratory No. 7553 R. H	None.
" 7554 G	"
" 7555 M. R	"
" 7556 S. B	"
Series 2. Special.	
Laboratory No. 7569 R. H	None
" 7571 S. B	"
" 7620 F. F	"
" 7622 P. F	"
" 7624 B. G	"

It will thus be observed that omitting the two samples Nos. 7485 and 7487, respecting which it has been stated that there was a strong probability of their obtaining nitrite nitrogen accidentally, not a single sample of unbleached flour gave any reaction.

BREAD FROM BLEACHED AND UNBLEACHED FLOURS.

Since the consumption of flour is chiefly in the form of bread, it becomes a question of very considerable interest to learn whether bread from bleached flour contains an appreciable amount of nitrites. The process of bread making in its latter stages is such, we might suppose, as would tend to a certain dissipation of the bleaching agent, provided the bread in baking were not exposed to the products of combustion. On the other hand, it would seem possible that in bread from unbleached flour, free from nitrites, in the operation of bread making there might be produced or absorbed sufficient nitrites to give the reaction. In the results of the experiments about to be detailed, we have information of a definite character on these two questions.

The baking was under the supervision of the Cerealist, and was accomplished in an electric oven. The fermentation was of comparatively short duration—the quantity of yeast being somewhat larger than that employed ordinarily—and the baking temperature high, which implies a short baking period. The loaves were necessarily of small size.

Bleached and unbleached flours, from certain of the samples already discussed, were used in this work. With respect to the unbleached, the commercial flours Nos. 7485 and 7487, which we have seen contained a certain amount of nitrites due to ex-

posure in the bleaching room, were baked. Bread was also baked from one sample of unbleached flour, free from nitrites. Four different samples of bleached flours containing varying amounts of nitrites, completed the series.

BREAD from Bleached and Unbleached Flours.

Laboratory No.	Designation.	Nitrite-reacting material as nitrogen.	
		In flour.	In bread.
		p. p. m.	p. p. m.
7484	Spring wheat flour, bleached	0·9	0·109
7484	" " " "	0·9	0·15
7485	" " " unbleached	0·4	None.
7486	Winter wheat flour, bleached	0·25	"
7487	" " " unbleached	0·09	"
7488	Yellow Cross flour, bleached	0·20	0·07
7490	Kubanka flour, "	Trace.	None.
7491	" unbleached	None.	"

The two commercial samples, Nos. 7485 and 7487, containing, though unbleached, ·4 and ·09 p.p.m. nitrite nitrogen respectively, furnished bread perfectly free from appreciable amounts of nitrites. This shows that even considerable amounts of nitrites may be entirely dissipated in the process of baking. The other sample of unbleached flour, No. 7491, contained no nitrites and its bread was similarly free.

Considering the bleached flours, we find that the sample No. 7484, containing ·9 p.p.m. nitrite nitrogen, yielded bread possessing ·109 p.p.m. on the first baking and ·15 on the second. This shows that, when the bleaching agent is present in a flour in considerable quantities, it may not be entirely discharged in bread making. No. 7486, a bleached flour containing ·25 p.p.m. nitrite nitrogen, gave bread with no nitrite reaction. The same is true of bread No. 7490, a bleached flour containing traces of nitrite. The bread of No. 7488, a flour which possessed ·20 p.p.m., was found to have retained ·07 p.p.m.

From these results we may conclude that flour free from nitrite-reacting material baked in an electric oven will yield bread free from nitrites. And, secondly, that flour containing considerable amounts of nitrite nitrogen if similarly baked, the bread therefrom may or may not be free, but in any case the amount will be very considerably reduced.

WATER ABSORPTIVE CAPACITY OF BLEACHED AND UNBLEACHED FLOURS.

In discussing the moisture-content in the flours employed in this investigation (page 198) it was pointed out that the bleached samples were invariably the drier. This fact, together with the statement made by some that bleached flour compared with unbleached from the same stock will produce the greater weight of bread, led us to inquire if bleaching affected temporarily or permanently the capacity of the flour to absorb moisture from the atmosphere.

Two flours were used, one from a spring wheat, the other from a winter variety. Portions of each were bleached, and consequently the series tested consisted of four samples. These were exposed in duplicate in a thin layer on large 'watch glasses' to the atmosphere of the laboratory from January 12 to February 8, 1910. Weighings were made at several intervals during this period and the changes noted. Since in all cases the duplicates gave closely concordant results, the averages only have been inserted in the table.

EFFECT of Exposure on Moisture-Content of Bleached and Unbleached Flours.

Laboratory No.	Designation.	Percentage of Moisture.					
		Initial 12.1.10	One day 13.1.10	Two days 14.1.10	Six days 18.1.10	Twenty-one days 2.2.10	Twenty-seven days 8.2.10
7484	Spring—Bleached	11·10	7·65	6·88	7·64	7·66	6·49
7485	" Unbleached	11·38	7·03	6·27	6·98	6·99	5·75
7486	Winter—Bleached	10·98	7·38	6·63	7·27	7·26	6·14
7487	" Unbleached	11·48	6·93	6 12	6 78	6·80	5 55

In considering these results, it will be interesting to note the general temperature and humidity of the atmosphere on the dates of weighing. Very cold and dry weather prevailed on the 12th, 13th and 14th. On January 18 it was damp and mild. It was mild and dry on February 2 and very cold and dry on the 8th.

The moisture-content of both bleached and unbleached samples is seen to fall off very rapidly; one day's exposure to the dry air resulting in a loss varying from 3·5 per cent to 4·5 per cent. A second day's exposure still further reduced the percentage of moisture, the additional loss varying from ·75 per cent to ·81 per cent. The change to a milder and less dry atmosphere resulted in a slight increase in the moisture-content on the 18th, the gain being from ·64 per cent to ·86 per cent, making the data almost identical with those of the 13th. The results of February 2 are practically the same as those of January 18—the mild and comparatively dry weather of February 2 having apparently no further influence on the moisture-content of the flour. On February 8, when it was very dry and cold, the flours again lost moisture, the amounts varying from 1·12 per cent to 1·25 per cent.

These results prove that the moisture-content of both bleached and unbleached flours, when similarly exposed, vary directly with the hygroscopic condition of the atmosphere.

Contrasting the bleached with the unbleached flour, the former, at the outset of the experiment, was in both instances the drier. It is significant to note that at each of the five subsequent weighings, the bleached flour contained more moisture than its companion (untreated) sample, which would indicate that any influence of the bleaching as regards the reduction of the moisture-content is only temporary. It would further seem that the bleaching agent so affects the flour that it loses less moisture under similar atmospheric conditions than the same flour untreated.

Immediately following the foregoing experiment (February 8), the 'watch glasses' containing the flours were placed over a vessel of water under a large bell jar and consequently were exposed to a saturated atmosphere. This was done in order to ascertain the relative absorptive capacity of the bleached and unbleached samples. Weighings were made on February 19 and 21, the following average results being obtained:—

EFFECT of Exposure to Saturated Atmosphere on Moisture-Content of Bleached and Unbleached Flours.

Laboratory No.	Designation.	Percentage of Moisture.		
		Initial 8.2.10	Eleven days 19.2.10	Thirteen days 21.2.10
7484	Spring—Bleached	6·49	19 87	19 86
7485	" Unbleached	5·75	19·07	19·07
7486	Winter—Bleached	6 14	19·38	19 25
7487	" Unbleached	5·55	19 12	19·19

The deduction from these data is that, exposed to a saturated atmosphere, the bleached flour absorbs a somewhat larger amount of moisture.

Considering, therefore, that bleached flour was found slightly drier and its absorptive capacity somewhat greater than unbleached flour, our results give some support to the contention that a slightly larger amount of bread could be obtained from the former.

LIGHT AND AIR AS BLEACHING AGENTS.

Certain experiments of a preliminary nature have been made with the view of learning the influence on flour of sunlight and air, separately and together, as bleaching agents.

Experiment I.—Portions of unbleached flour, No. 7622 (which had been shown to be free from nitrites) were placed between clean glass plates, the layer of flour being about ¼ of an inch thick. The plates were bound together at the edges with gummed paper, so that there was no free access of air to the flour. One pair of plates was completely covered with black paper to exclude the light. Both pairs were exposed in bright sunlight, the temperature of the air being considerably below the freezing point. The first examination of the samples was made at the end of one hour, when it was found that the flour exposed to the sunlight was distinctly paler than that covered with black paper. This bleaching effect of sunlight was still more marked at the end of the second and third hours of exposure. As the only air present was that imprisoned between the flour particles, we have in the results of this experiment direct evidence of the bleaching action of sunlight.

Experiment II.—Portions of the same flour weighing about 30 grammes were spread on large 'watch glasses' (diameter 4 inches) and exposed to the air; (a) in direct sunlight, and (b) in comparative darkness. The sample submitted to the influence of air and light (a) was placed under a large glass funnel, so arranged that air could freely circulate over the surface of the flour. In order to protect the other sample. (b), from light the 'watch glass' containing the flour was placed under an inverted brass sieve, the arrangement allowing free passage of the air, but excluding light. The flour exposed to light and air (a) bleached rapidly; that in air, protected from light was similarly affected, but the bleaching was very much less pronounced. There seems no doubt, therefore that air in the absence of direct sunlight exercises a bleaching influence.

To determine if flour bleached by exposure to air and light had taken up nitrite-reacting material from the air, the two samples, (a) and (b), were examiued at the close of the experiment by the Griess-Ilosvay method. Both samples were found to contain nitrite nitrogen to the extent of ·05 p.p.m.

FLAX SEED.

As is probably well known, flax seed is generally characterized by large percentages of protein and oil and consequently is a grain possessing a high nutritive value. Though this is true, considerable differences in composition (especially as regards oil-content) are known to exist and flax seed upon the market is by no means uniform. In his work with flax the Cerealist, therefore, undertook to produce a number of strains of fixed character by propagation from single selected plants. Recognizing that the values of flax seed must depend to a large extent on the richness of the seed, he deemed it desirable to have analyses made of the best from among these strains before further carrying on his studies of them in the field. Twenty samples, representing as many distinct strains, grown on the Experimental Farm, Ottawa, in 1909, were therefore submitted to analysis, the determinations made being oil, protein and weight of 1,000 kernels.

FLAX, 1909.

Laboratory No.	Name.	Oil.	Protein (N x 6·25)	Weight of 1000 Kernels.
		%	%	Grammes.
7766	Whito Flowering A	36 80	19·06	5·1588
7767	" " B	37·85	23·75	4·7324
7768	Common A	34·50	27·56	4·4928
7769	" B	35 77	26·69	4·4420
7770	" C	34·62	24·19	4 2454
7771	" D	35·64	24·00	3 9014
7772	" R	35·28	27·37	4·3328
7773	" S	36·01	27·00	4·1556
7774	Yellow Seed A	38·16	25·75	4·3224
7775	" " B	37·02	26·25	4·2390
7776	" " C	38·26	25·31	4·5012
7777	La Plata A	42·20	20·25	8·8538
7778	" B	39 76	21·31	7·9780
7779	" C	40·82	21·94	5·9750
7780	Russian A.	35·74	26·06	4·3646
7781	" B	35·35	27·43	4 3850
7782	Riga A	36·25	25 81	4·2542
7783	" B	36·70	27 25	4 5422
7784	" C	35·35	25·25	3·9122
7785	Novarossick B	39·94	22·12	5 5110
	Average	37·10	24·77	4·9151

Oil.—The percentage of oil varies from 34·50 to 42·20, while the average of the series is 37·10.

Considerable differences between strains from the same variety are to be noticed, amounting in some cases to as much as 1·5 per cent. Examples of strains differing markedly from one another in oil-content are to be found in almost every variety under examination. The three strains of La Plata stand first in the series as regards oil-content.

Protein.—The percentage of protein varies from 19·06 to 27·56, the average for the series being 24·77.

As with the oil, but in a still more marked degree, differences between closely related strains occur. Thus in one instance (Nos 7766 and 7767) the difference in protein is more than 4 per cent.

A study of the data shows that while there is a relationship between the oil and protein content no constant ratio exists. In a general way, however, the tendency is for the protein to vary inversely as the oil.

The datum 'weight of 1,000 kernels' varies greatly, the extremes in the present series being 3·9044 grms. and 8·8538 grms. The average for 20 samples is 4·9151 grammes.

Attention may be directed to the results for La Plata A and B (Nos. 7777 and 7778), which are very considerably higher than the figures obtained for the other samples. They are associated with a particularly large and plump seed.

An attempt at correlation of these data with those for the oil and protein does not reveal any relationship. It was, however, very evident on inspection of the samples that the weight varied with the size—the larger the seed the heavier the weight per 1,000 kernels.

INOCULATION EXPERIMENTS WITH NITRAGIN FOR LEGUMES.

Experiments with specially prepared cultures for the growth of legumes were commenced by us in the spring of 1897 and have been continued, almost uninterruptedly, since that date. During this period the merits of almost every culture upon the market have been studied and reported on.

In the spring of 1909, trials were begun with Hiltner's Nitragin as prepared by the Dr. Reiche Nitragin Company, of Milwaukee, Wis., U.S.A., cultures being used for Red Clover, Alfalfa and Pease. The methods of both seed and soil inoculation were followed, the series comprising trials in pots and plots.

Red Clover—Pot Experiment.

Date of sowing, May 19th ; Date of first cutting, Aug. 27th ; Date of second cutting, Oct. 10th.	Uninoculated.	Seed inoculated.	Soil inoculated.
	Grammes.	Grammes.	Grammes.
First cutting, green	97·3	109·7	125 9
Second " "	73·9	69·3	104·4
Total " "	171 2	179 0	230·3

The soil used in the pot series was an extremely light, sandy loam, taken from the area devoted to the plot experiments and which had not carried a legume crop for many years. Its nitrogen content was ·101 per cent.

At the date of the first cutting there was no appreciable difference in appearance, but, as the above data show, the growth from the inoculated crops was heavier than that from the untreated. When cut the second time, there was similarly but little difference in appearance between the pots. In considering the total weight, the yields from the uninoculated and seed inoculated pots were seen to be very close—the difference is not sufficient to indicate any material advantage from the use of the culture. With the soil inoculated, however, the yield was markedly higher than from the untreated pots, the increase presumably being due to the use of the culture.

RED CLOVER.—PLOT EXPERIMENT.

The 'catch' of clover on all the plots from the first seeding, May 19, was owing to the dry weather that prevailed, very poor. It was, therefore, decided to reseed, which was done on June 19. At the close of the season the growth was very irregular on all the clover plots, and it was consequently thought undesirable to record the relative yields. These plots were left for experimentation during the season of 1910.

ALFALFA—Pot Experiment.

Date of sowing, May 19; date of first cutting, August 27; date of second cutting, October 13.	Un-inoculated.	Seed inoculated.	Soil inoculated.
	Grammes.	Grammes.	Grammes.
First cutting, green	58·4	55·1	55·0
Second cutting, green	69·2	63·5	71·8
Total	127·6	118·6	126·8

Though no great differences were to be remarked between the pots at the date of the first cutting, the plants in the uninoculated pots appeared somewhat the healthiest. The total yields do not indicate any benefit from the use of the culture.

ALFALFA—Plot Experiment.

Date of sowing, May 19; date of first cutting, August 3; date of second cutting, Sept. 29	Uninoculated.				Seed inoculated.				Soil inoculated.			
	Fresh.		Air dried.		Fresh.		Air dried.		Fresh.		Air dried.	
	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.
First cutting	10	3	2	6	4	12	1	3	11	3	2	11
Second cutting	18	9	4	13	14	10	3	12	17	2	4	10
Total	28	12	7	3	19	6	4	15	28	5	7	5

The three plots constituting the series were each 8′ x 12′. The seeding was at the rate of 25 lbs. per acre.

The yields from the uninoculated and the soil inoculated plots are practically identical, that from the seed inoculated area being decidedly less. It is interesting to note that the results from the pots and plots correspond and consequently confirm one another.

The plots, as in the case of the clover, have been left for trial during 1910, to learn the effect of the culture on the second year's growth.

PEAS—Pot Experiment.

Date of sowing. May 19; date of cutting, July 30.	Un-inoculated.	Seed inoculated.	Soil inoculated.
No. of plants	17	16	17
No. of pods	47	42	36
	Grammes.	Grammes.	Grammes.
Weight of plants, green	180·7	192·4	149·1
Weight of pods, green	98·5	72·4	74·2
Total weight	279 2	264·8	223·3
Weight of plants, air-dried	46·6	53·1	38·3
Weight of pods, air-dried	17·0	12·2	11·1
Total weight	63·6	65·3	49·4

When cut, July 30, the uninoculated and seed inoculated pots were very similar in appearance and were decidedly superior to the soil inoculated pot, a deduction confirmed by the yields taken either green or air-dried. It is evident, therefore, that no beneficial effect resulted from the employment of the culture.

PEAS—Plot Experiment.

The plots used for the peas adjoined those of the alfalfa and clover series and were similar to them in size. The seeding was at the rate of 3 bushels per acre. The variety was Golden Vine.

YIELD from Inoculated and Untreated Plots.

Date of sowing, May 19; date of cntting, August 3.	Yield.			
	Fresh crop.		Air-dried crop.	
	Lbs.	Oz.	Lbs.	Oz.
Uninoculated	54	12	13	13
Seed inoculated	46	1	12	6
Soil inoculated	49	10	12	4

The largest yield, weighed either green or cured, was from the untreated plot, indicating that on this soil at least there is no advantage in inoculation. That inoculation is unnecessary is borne out by the results of our examination of the roots of the alfalfa and peas. In both number and size the nodules on the roots of the plants from the uninoculated plots did not fall behind those of the plants which had been inoculated. Our experience, from trials covering a very considerable period, leads us to believe that special inoculation is not generally necessary in eastern Ontario. This is probably also true for the most cultivated districts of eastern Canada, though certain isolated instances in which apparently considerable benefit had followed inoculation are not unknown to us.

On a tour through several of the larger agricultural areas of British Columbia, made a few years ago, the writer took especial care to obtain information respecting the growth of clover and other legumes. The luxuriant crops of alfalfa and of various clovers that were to be observed alike on the coast and on the irrigated soils of the semi-dry belt furnished convincing evidence that inoculation could not be generally necessary in that province. Moreover, in further support of this statement, it may be said that nodules containing the nitrogen-assimilating bacteria were found on the roots of every legume examined. The most noticeable benefit from inoculation has been in the northwestern provinces, a striking example of which at Lacombe, Alta., was recorded in our report for 1909. In this instance the inoculating material was surface soil taken from a field growing alfalfa on the Experimental Farm at Lethbridge, Alta., the application being made at the rate of 300 lbs. per acre. This method of inoculation with soil has of all methods proved the most effective and successful and is to be recommended in preference to the employment of cultures, where inoculation is thought necessary or desirable.

In conclusion, we may point out that failure to obtain a catch of clover or other legume does not necessarily imply the absence of the nitrogen-assimilating bacteria; it more often is due to deficiency of moisture, an unsuitable seed bed, an acid condition of the soil or to a lack of proper drainage. Seed of a low germinative value has also been found answerable for an imperfect catch. Before concluding that inoculation is necessary it would therefore be the part of wisdom to enquire if the lack of success may not be due to one or more of these unfavourable conditions, or to poor seed.

THE RELATIVE VALUE OF FIELD ROOTS.

With the view of obtaining some knowledge respecting the relative feeding values of the leading varieties of field roots, we began in 1904 the analysis of the mangels, turnips, carrots, &c., as grown on the Central Experimental Farm, Ottawa. The present report, therefore, gives the results of the sixth season's work.

MANGELS.

The fourteen varieties of mangels grown during the season of 1909 were submitted to analysis. The names of some of these varieties appear here for the first time, but it is not at all improbable that several of these apparently new sorts have been grown and reported on under other names. The practice of certain seed growers and vendors in putting on the market well-established varieties under new names causes considerable difficulty in such an investigation as this, in which it has been sought to ascertain among other things the influence of heredity on the composition of the root.

Though in the following list it is possible that some three or four are new varieties, or more correctly speaking new strains, by far the larger number have long been known to our farmers.

The determinations made comprise dry matter, sugar in juice and weight of root, the two former being considered a measure of the feeding value. The varieties are arranged in the subjoined table in the order of their dry-matter content.

ANALYSIS of Mangels, Central Experimental Farm, Ottawa, Ont.. 1909.

Variety.	Water.	Dry Matter.	Sugar in Juice.	Average Weight of One Root.	
	p. c.	p. c.	p. c.	Lbs.	Oz.
Giant Sugar	87·34	12·66	7·40	2	9
Prize Mammoth Long Red	87·40	12·60	7·56	2	8
Giant White Feeding Beet	87·61	12·39	6·92	3	7
Gate Post	88·18	11·82	6·64	3	14
Yellow Intermediate	88·40	11·60	6·14	2	15
Crimson Champion	88·64	11·36	6·71	4	8
Selected Yellow Globe	88·65	11·35	6·47	2	7
Half Sugar White	88·74	11·26	5·82	3	8
Giant Yellow Intermediate	88·79	11·21	7·32	2	5
Perfection Mammoth	88·96	11·04	5·04	4	5
Giant Yellow Globe	89·05	10·95	5·82	3	7
Giant Yellow Intermediate	89·32	10·68	5·22	3	11
Mammoth Red Intermediate	90·91	9·09	5·39	3	8
Our Ideal	91·06	8·94	4·47	3	9

Though in this table the varieties follow one another fairly closely in their dry-matter and sugar-content, it will be noticed that the differences that exist between the richest and the poorest of these roots are very considerable; thus we find between the first and the last members of the series a difference equivalent to 29 per cent of the dry matter and 39 per cent of the sugar present. These facts are in accord with our previous findings and serve to demonstrate the advisability of considering the composition as well as yield and keeping quality in the selection of a variety.

The figures representing the average composition of the mangels for the past six years are of considerable interest, first in showing that the roots of the past season come very close in dry matter and sugar to the average of the six years, and, secondly, that when the investigation includes a number of practically the same varieties, average figures are obtained that do not vary greatly from year to year.

MANGELS—Average Composition, 1904-1909.

Year.	Number of Varieties Analysed.	Average Weight of One Root.		Dry Matter.	Sugar.
		Lbs.	Oz.	p. c.	p. c.
1904	10	2	11	11·69	6·62
1905	17	3	19	10·04	4·67
1906	16	2	7	11·63	5·93
1907	10	2	11	12·64	7·46
1908	12	2	2	11·87	5·33
1909	14	3	5	11·21	6·21
Average for six years 1904 9				11·51	6·03

In addition to the influence of heredity upon the composition of roots—a matter we shall discuss briefly in a subsequent paragraph—the size of the root is a potent

factor in determining the dry matter and sugar-content. Thus, in 1905, the average weight was the highest in the series and the percentages of dry matter and sugar the lowest. As the character of the season is undoubtedly one of the chief factors regulating size, the influence of season on composition is obvious.

INFLUENCE OF HEREDITY IN MANGELS.

We have already remarked upon the effect of size and season on composition and alluded to heredity as a further factor influencing the feeding value of roots. In order to learn to what degree characteristics of composition in mangels may be attributed to heredity, we selected ten years ago two well known and distinct varieties—Gate Post and Giant Yellow Globe—which at that time appeared to represent the extremes of composition in this class of roots. These have been grown annually side by side since that date and analysed.

Dry Matter and Sugar in Gate Post and Giant Yellow Globe Mangels.

Seasons of Growth.	Gate Post.				Giant Yellow Globe.			
	Average Weight of One Root.		Dry Matter.	Sugar in Juice.	Average Weight of One Root.		Dry Matter.	Sugar in Juice.
	Lbs.	Oz.	p.c.	p.c.	Lbs.	Oz.	p.c.	p.c.
1900	.....	.....	11·14	6 15	.....	.....	8·19	2 64
1901	2	9	9·41	4·15	3	3	9·10	4·08
1902	3	2	13·90	9·39	3	9	10 24	5·24
1903	3	3	12·93	7·38	3	13	10·89	6·17
1904	2	14	12·64	7·62	2	13	9·24	5·26
1905	2	13	12·07	6·83	3	12	8 64	3·55
1906	2	2	12·90	6·59	1	8	12·73	6·45
1907	3	10	12·53	7·25	2	7	10·78	6·34
1908	1	11	12·02	4·94	2	4	10 66	4·47
1909	3	14	11·82	6 64	3	7	10·95	5·82
Average for 10 years	.....	.....	12·14	6·69	....	....	10·14	5·00

Without a single exception the Gate Post has shown itself the superior variety, both in respect to dry matter and sugar. The fact that these varieties have maintained, practically, their relative positions for ten consecutive seasons goes far towards establishing the contention that heredity plays an important part in determining the composition of the root. It would seem from these results that there is a profitable field for work in breeding rich feeding roots and that possibly as much improvement might be effected in that direction as has followed the special breeding of sugar beets for sugar production during the last twenty years.

TURNIPS.

In the season of 1909, thirteen varieties of turnips were grown on the Central Experimental Farm and analysed. Though the differences throughout the series in dry matter and sugar are not so marked as in the case of the mangels, the data afford substantial evidence that all varieties of turnips are not alike in feeding value.

ANALYSIS of Turnips, Central Experimental Farm, Ottawa, Ont., 1909.

Variety.	Water.	Dry Matter.	Sugar in Juice.	Average Weight of One Root.
	p.c.	p.c.	p.c.	Lbs. Ozs.
New Century	87·34	12·66	1·69	2 9
Hall's Westbury	88·14	11 86	1·47	2 2
Halewood's Bronze Top	88 29	11·71	1·51	2 15
Good Luck	88·43	11·57	1·79	2 9
Skirvings	88·52	11·48	1·28	1 15
Jumbo	88 74	11·26	1·48	3 8
Hartley's Bronze Top	88 80	11·20	1·48	2 8
Carter's Elephant	88·92	11·08	1·63	2 9
Perfection Swede	88 95	11·05	1·37	2 2
Kangaroo	89·01	10·99	0·99	3 5
Mammoth Clyde	89·20	10·80	1 26	2 4
Magnum Bonum	89 33	10·67	1·18	3 1
Bangholm Selected	89·42	10 58	1·42	2 12

The fact is apparent from these results that while the percentage of dry matter approximates that of mangels, the sugar-content of the latter is very considerably greater, and hence mangels must be regarded as superior in feeding properties.

The averages for the past five years are subjoined and indicate that the roots of the past season were of an average quality.

TURNIPS.—Average Composition, 1905-1909.

Year.	Number of Varieties Analysed.	Average Weight of One Root.	Dry Matter.	Sugar.
		Lbs. Ozs.	p.c.	p.c.
1905	20	2 13	10·09	1·10
1906	20	1 10	12·18	1 78
1907	14	3 5	10·14	1·11
1908	13	3 12	9·87	1·52
1909	13	2 10	11·30	1·43

CARROTS.

Six varieties were grown and analysed, five of which are the same as those reported on last year. As hitherto noticed, there is a closer approximation in composition among carrots than is found in mangels. Nevertheless, in conjunction with other features, such as yield and keeping quality, the question of variety is worthy of some consideration.

ANALYSIS of Carrots, Central Experimental Farm, Ottawa, Ont.

Variety.	Water.	Dry Matter.	Sugar in Juice.	Average Weight of One Root.
	p.c.	p.c.	p.c.	Lbs. Ozs.
Half Long Chantenay	88 44	11·56	3·36	0 10
Ontario Champion	89·17	10·83	3·19	1 0
White Belgian	89·63	10·37	2·06	0 15
Mammoth White Intermediate	89·90	10·10	2·08	1 1
Mammoth Intermediate	90·00	10·00	1·75	1 2
Improved Short White	90·46	9 54	1·38	1 4

The table of averages serves to emphasize what has been noted in past reports—a remarkable uniformity in the composition of carrots when practically the same varieties are included from year to year in the investigation. We might, therefore, deduce that seasonal influences did not affect carrots in the same degree as other field roots and especially mangels.

CARROTS.—Average Composition, 1905-1909.

Year.	Number of Varieties Analysed	Average Weight of One Root.		Dry Matter.	Sugar.
		Lbs.	Ozs.	p.c.	p.c.
1905	11	1	3	10·25	2·52
1906	10	1	2	10·59	3 36
1907	6	1	1	10·30	3·02
1908	6	1	3	10·89	3·34
1909	6	1	0	10·40	2·30

SUGAR BEETS FOR FACTORY PURPOSES.

In accordance with our custom for many years past we have again submitted to analysis the leading varieties of factory beets—Vilmorin's Improved, Klein Wanzleben and Très Riche—as grown on the several Experimental Farms.

SUGAR Beets Grown on the Dominion Experimental Farms, 1909.

Variety.	Locality.	Percentage of Sugar in Juice.	Percentage of Solids in Juice.	Co-efficient of Purity.	Average Weight of One Root.		Yield per Acre.	
					Lbs.	Ozs.	Tons.	Lbs.
Vilmorin's improved	Nappan, N.S	17·52	19·83	88·3	0	15	12	1,575
"	Ottawa, Ont	13·43	16·20	82·9	1	10	15	1,600
"	Brandon, Man	17·89	22·37	79·9	1	8	19	1,336
"	Indian Head, Sask	17·25	19 89	86·7	1	9	14	248
"	Lethbridge, Alta, irrigated	18 59	20·24	91·8	1	8	24	510
"	" " non-irrigated	17·05	19 69	86·6	1	3	11	1,760
"	Lacombe, Alta	13·16	19·17	68·6	0	12	5	296
"	Agassiz, B.C	18·28	19·63	93·1	1	3	12	420
Klein Wanzleben	Nappan, N.S	16 63	18·67	89·0	0	14	13	1,225
"	Ottawa, Ont	16·48	17·91	92·0	1	4	14	1,900
"	Brandon, Man	17·33	21·17	81·8	1	7	12	1,976
"	Indian Head, Sask	16·94	19 69	86·0	1	7	15	624
"	Lethbridge, Alta, irrigated	17·74	19·49	91 5	1	8	24	1,500
"	" " non-irrigated	17·44	20·29	85·9	1	4	6	1,860
"	" " irrigated (Raymond Seed)	17·68	19·69	89 7	1	10	18	630
"	Lethbridge, Alta, non-irrigated (Raymond Seed)	21·17	23·49	90·1	0	14	4	1,900
"	Lacombe, Alta	11·83	15·43	76·7	0	13	4	1,768
"	Agassiz, B.C	17·80	19 43	91 6	1	1	12	288
Très Riche	Nappan, N.S.	16·05	17·97	89·3	1	1	14	875
"	Ottawa, Ont	14·62	16·37	89·3	1	15	15	1,000
"	Brandon, Man	21·26	24·76	85·8	1	3	13	1,192
"	Indian Head, Sask.	17·28	20·03	85·1	1	5	13	1,558
"	Lethbridge, Alta, irrigated	17·64	19·17	92·0	1	3	24	510
"	" " non-irrigated	17·78	20·23	87·8	0	14	9	810
"	Lacombe, Alta	13·33	16·47	80·9	0	11	4	448
"	Agassiz, B.C	18·83	20·89	90·1	1	3	8	424

With one or two exceptions, the sugar-content and 'purity' data are exceedingly satisfactory. On the larger number of the Farms, and more particularly at Brandon and Indian Head, the season appears to have been more than usually favourable for large yields of rich roots, a sufficiency of rain during the earlier months being followed by a dry, warm autumn.

We have again to record very poor results, both as to quality and yield, from Lacombe, Northern Alberta. A very late spring and generally 'dry' season militated against good returns from all root crops at this Farm.

For the second season, sugar beets from irrigated and non-irrigated areas on the Experimental Farm at Lethbridge, Southern Alberta, have been examined. The results are extremely interesting. Comparing beets grown under 'dry farming' methods with those provided artificially with water, we find that in two cases only out of the four the non-irrigated beets are the richer, and in one instance only is the difference at all significant. This in the main is in accord with the results of the previous season (1908) and does not lend any substantial support to the contention that the irrigated crop would be the poorer in sugar.

The 'purity' of the beets from both irrigated and non-irrigated plots is extremely satisfactory, the former having slightly the advantage.

The yields from the irrigated areas are from two to four times those from the corresponding non-irrigated plots, and it is a matter of much satisfaction to note that this very large increase has not been obtained at the expense of quality.

Averages from the three varieties for the past eight seasons are presented in the following table . They allow us to compare the sugar-content of these beets, season by season, as grown at widely distant points in the Dominion.

AVERAGE Percentage of Sugar in Juice in Sugar Beets Grown on Experimental Farms, 1902-1909.

Locality.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.
Nappan, N. S.	15·87	15·33	14·41	16·52	17·08	....	17·53	16·74
Ottawa, Ont.	16·77	15·34	16·91	12·45	14·37	15·44	16·30	14·84
Brandon, Man.	......	11·36	16 62	11·09	15·50	16·99	15·82	18·83
Indian Head, Sask.	15·15	16·54	15·24	14·94	14·91	15·92	15 66	17·16
Lethbridge, Alta.—irrigated	......	....	......	....	....	......	16·09	17·91
" " non-irrigated	....	......	....	......	....	....	16·73	18·36
Lacombe, Alta.	......	....	....	....	....	13·34	11·21	12·77
Agassiz, B. C.	......	17·44	8·10	17·32	14·23	17·65	17·15	18·30

That the season of 1909 has been a very favourable one at nearly all the Experimental Farms will be apparent on comparing the data of the last column of the above table with those obtained for the preceding years. The figures indicate, in almost every instance, a very superior root for factory purposes.

THE MOISTURE-CONTENT OF PACKED AND UNPACKED SOILS.

The importance of sub-surface packing for the conservation of moisture has been greatly emphasized in connection with soil culture in semi-arid districts.* This packing is, presumably, the distinguishing feature of the much heralded system of 'dry-farming,' an unfortunate term, by the way, since it leads the uninitiated to suppose that equally successful crops may be grown with less moisture than in humid regions, which of course is not the case. The effect of the smaller amount of water furnished the soil in districts of sparse precipitation is counter-balanced in 'dry-farming' by special methods of culture which result in the conservation of moisture. These comprise the preparation by deep ploughing of a thick layer of soil which, by reason of its improved texture, is capable of holding much moisture. The ploughed land is at once 'packed,' for which purpose a special implement is employed. The general form of machine known as a 'sub-surface packer' resembles a disc harrow, the wheels or discs of which have bevelled rims. The object of the operation is to 'firm the lower part of the furrow slice and leave the surface loose.' In this way capillarity is re-established and the stores of moisture in the subsoil are made more readily available for the growing crops. Cultivation with a tooth harrow immediately follows the packing in order to prepare a 'dry earth mulch.' This has the effect of checking evaporation. Cultivation is repeated after every rain throughout the season, or at all events as often as is deemed requisite to prevent the caking of the surface soil and to keep the land free from weeds.

To ascertain what additional amounts of water might be brought up by packing and stored in the surface soil, determinations have been made during the past season of the moisture in the soil to a depth of 14 inches in areas packed and not packed, but otherwise similarly treated and cultivated on the Experimental Farms at Lethbridge and Lacombe, Alta.

The data from the packed and unpacked areas in summer-fallow at Lethbridge are as follows:—

Moisture-content of Soils—Packed and Unpacked—Experimental Farm, Lethbridge, Alta.

Date.	Percentage of Moisture.	
	Packed.	Unpacked.
July 16, 1909	13·55	13·35
August 21, 1909	13·68	12·36
October 1, 1909	11·21	11·22
November 2, 1909	11·13	10·21

The first samples were collected immediately after the fallow had been prepared, and, as may be seen from the data, the moisture-content was the same for both areas. Five weeks later, when the second series of samples were taken, the packed soil was the richer in moisture by approximately 1·3 per cent. The third series, collected on October 1 were identical as to water-content, but on November 2, when the last samples were forwarded, the packed soil contained nearly 1·0 per cent more moisture.

* Summer-fallowing as a means of conserving moisture and keeping the land free from weeds was first practised by Mr. Angus Mackay, Superintendent of the Experimental Farm, Indian Head, Sask., and has been widely adopted for the past twenty years in the wheat-growing areas of the Canadian Northwest. The immense value of fallowing as a means of storing up moisture for the crop of the succeeding year was shown by determinations of the soil-moisture in fallowed and stubble lands in 1900, the data appearing in the report of the Chemist for that year.

The treatment of the land at Lacombe from which the samples were taken may be described as follows: The land carried a barley crop in 1908 and was ploughed in the fall of the same season. Part of the fall-ploughed land was immediately sub-surface packed. No cultivation was given in the spring of 1909 previous to the taking of the first samples. After these were collected, both areas were harrowed and seeded with barley. Those plots packed in the fall of 1908 were again packed after the barley was sown and no further cultivation given to either plot.

Moisture-content of Soils, Packed and Unpacked—Experimental Farm, Lacombe, Alta.

Date.	Percentage of Moisture.	
	Packed.	Unpacked.
May 14, 1909	11·93	11·55
August 23, 1909	7·59	7·48

The difference in moisture-content at the date of the first collection (May 14) was less than ·5 per cent, the packed soil being the more moist. On August 23, when the barley was harvested, the differences was still less, though such as it was showed that the packed soil had the advantage.

It is not claimed that this preliminary examination furnishes data of a conclusive character—it will be necessary to repeat the work under different seasonal conditions, probably determining the soil-moisture more frequently—but it is significant that this year's results show no very great advantage from the use of the sub-surface packer.

THE FERTILIZING VALUE OF RAIN AND SNOW.

The analysis of the rain and snow as falling at Ottawa was begun in the early months of 1907, and has been continued since that time. We are, therefore, now able to present data for the third year's work in this investigation.

The determinations comprise free and albuminoid ammonia and nitrogen in nitrates and nitrites, and from the results so obtained and the monthly precipitation data, the amounts of organic and saline nitrogen furnished per acre per annum are calculated.

Rain and Snow at Ottawa for the Year ending February 28, 1910.

Month and Year.	Precipitation in Inches.			Nitrogen.				Pounds of Nitrogen per Acre.
	Rain.	Snow.	Total in Inches of Rain.	In Free Ammonia.	In Albuminoid Ammonia.	In Nitrates and Nitrites	Total.	
1909.				p.p.m.	p.p.m.	p.p.m.	p p.m.	
March	1·38	24·00	3·78	·301	·107	·177	·585	·501
April	2·96	7·50	3·71	·245	·457	·585	1·287	1·082
May	5·84	....	5·84	·507	·102	·300	·909	1·203
June	2·53	....	2·52	·494	·127	·366	·987	·564
July	4·69	....	4·69	·374	·072	·198	·644	·684
August	3·11	....	3·11	·490	·103	·209	·802	·565
September	2·81	....	2·81	·397	·101	·301	·799	·508
October	1·11	....	1·11	·973	·091	·065	1·129	·284
November	2·93	2·50	3·18	·332	·122	·548	1·002	·722
December	......	15·00	1·50	·175	·070	·053	·298	·101
1910.								
January	1·36	9·50	2·31	·307	·108	·112	·527	·276
February	·08	22 25	2 30	·335	·108	·284	·727	·379
Total for 12 months	28·79	80·75	36·86	....	....	....	....	6·869

During the year ending February 28, 1910, 75 samples of rain and 36 of snow were analysed.

The total precipitation for the year was 36·86 inches, slightly more than two inches above the average (34·78 inches) for the past 19 years. Of this precipitation, 28·79 inches fell as rain and 8·07 inches as snow. By reason of the rainfall being somewhat larger and the snowfall considerably less than usual, the proportion of the total fall as rain during the past year was higher than the average.

There was no season of drought and reference to the data shows that the precipitation was very fairly distributed throughout the summer months. The total amount of nitrogen furnished per acre for the 12 months ending February 28, 1910, stands practically midway between the amounts recorded for the two previous years, as will be apparent from the following tabulated statement.

—	Rain in inches.	Snow in inches.	Total precipitation in inches.	Pounds of Nitrogen per Acre.
Year ending, February 28, 1908	24·05	133·0	37·35	4·323
" " 28, 1909	22 99	96·25	32·63	8·364
" " 28, 1910	28·79	80·75	36·87	6·869
Average for 19 years	25·52	92·56	34·78	

As stated in our last report*, we surmised that the amount of nitrogen found for the year ending February 28, 1909, was abnormally high, owing to the prevalence of bush fires during the late summer and autumn months of 1908 in the Ottawa valley and neighbouring districts, resultiug in the atmosphere being heavily charged with smoke. No such fires occurred during the past summer. It was also pointed out that a further disturbing factor of the summer of 1908 was the high winds that prevailed from time to time in periods of drought. Such winds naturally fill the atmosphere with light particles of soil and organic debris which are washed out by the raiu, increasing the nitrogen-content of the latter. As during the summer of 1909, in this district. there were practically no such dry periods, with high winds, the data for the past year represents more accurately the amounts of the nitrogen compounds normally present in the rain and snow. Of the total amount of nitrogen furnished per acre, 6·87 lbs., approximately 4·46 lbs. or 65 per cent occurred as free and organic ammonia and 2·41 lbs. or 35 per cent as nitrates and nitrites.

AVERAGE Nitrogen-Content of Rain and Suow—Amount of Nitrogen per Acre, as Free and Albuminoid Ammonia and as Nitrates and Nitrites.

—	Number of samples analysed.	Precipitation in inches.	Nitrogen. Parts per Million. In Free Ammonia.	In Albuminoid Ammonia.	In Nitrates and Nitrites.	Total.	Percentage of Total. In Free Ammonia.	In Albuminoid Ammonia.	In Nitrates and Nitrites.	Per Acre. As Free and Albuminoid Ammonia.	As Nitrates and Nitrites.
										Lbs.	Lbs.
Rain	75	28·79	·429	·148	319	·894	48	17	35	3·79	2·04
Snow	36	80·75	·269	·097	·203	·569	47	17	36	·67	·37

* Report of the Chemist, 1909, page 191.

The nitrogen furnished by the rain was 5·83 lbs. or approximately 85 per cent of the whole; that by the snow was 1·04 lbs. or about 15 per cent.

The greater richness of the rain in nitrogen compounds is again evident, though the difference between the rain and snow in this regard is not so marked as in the previous season, which, as we have stated, was undoubtedly abnormal. Our three years' work, therefore, shows that, both relatively and absolutely, rain furnishes more nitrogen to the soil than snow.

The proportion or distribution of the nitrogen compounds is very similar to that of the two previous years. In both rain and snow the averages of the year show that the proportion of nitrogen as free ammonia is the largest and that as albuminoid ammonia the smallest. The figures in columns 8, 9 and 10 of the table are remarkable in showing that, when averages are taken for the season, the percentages of the total nitrogen present as 'free ammonia,' 'albuminoid ammonia' and as 'nitrates and nitrites' are the same for both rain and snow.

THE WATER SUPPLY OF FARM HOMESTEADS.

From the outset the Experimental Farm system has sought to impress on Canadian farmers the very great importance of an abundant supply of good, pure water on the farm homestead, and has further made very clear the dangers involved in using water from a polluted source. This has been educational rather than research work, but for this reason it has been none the less valuable in the years that have gone by. Looking back over the past twenty-three years it might perhaps be difficult to find any branch of the work of this Division that has been of more practical and immediate benefit to our farmers than has been this matter of water analysis, and the reporting on locations for the site of the farm well and related subjects. Over 2,000 samples of water from rural homes have been analysed in the Experimental Farm laboratories, and every sample has been reported upon fully to the sender, the data being accompanied by a pronouncement upon the nature and quality of the water, the character of the pollution when such has been found present, and the possibility of improving the supply if such be necessary.

Over the larger part of the Dominion it is by no means a difficult matter to obtain a good supply, i.e., a wholesome water in sufficient abundance for house and stock use. There is probably no better watered country in the world than Canada—either from the standpoint of quantity or quality. The waters of the innumerable lakes, streams and springs with which the Dominion abounds are naturally of the purest, and the same may be said in even more emphatic language as regards the underground, deep-seated waters, to which we must look for our farm supply in the larger number of instances. It is only in those districts in northwestern Canada characterized by a sparse precipitation, or where what might be termed semi-arid conditions prevail, that the obtaining of a desirable supply may become a matter of anxiety and great difficulty. In such regions potable water is frequently scarce and means of purification, as by distillation, must be resorted to in order to obtain a supply free from saline matter.

On the larger number of farms, therefore, in the older provinces of the Dominion, a supply of good water is not an impossibility, though in obtaining it and piping it to the house and farm buildings there will be, of course, some expenditure, varying with the circumstances. It is against the barnyard and back-door well that we again utter an emphatic protest. The water in such may remain good for a few years after the homestead is established, but sooner or later the soil surrounding such wells must become saturated and clogged with organic filth and unable to perform its useful work of purification. It is thus, more frequently than by the inflow of purely surface washing, that manurial matter finds its way into the well. Fully 90 per cent of the polluted waters reported on by us are from shallow wells situated as we have described, and not a few of them have been proved to be veritable cesspits. The drilled or bored well, tapping a deep source, located at a safe distance from possible sources of pollution and effectively protected from the entrance of surface wash, is undoubtedly what we should advise on the majority of farms; it might be depended on to furnish, in the larger number of cases, an ample supply of good, wholesome water.

Of the 79 waters reported on in the appended tabulated data, 31 have been returned as wholesome, 26 as suspicious, 11 as seriously contaminated, and 11 as saline.

ANALYSES OF WELL WATERS, 1909-10.

RESULTS STATED IN PARTS PER MILLION.

Number.	Locality.	Marks.	Date.	Free Ammonia.	Albuminoid Ammonia.	Nitrogen in Nitrates and Nitrites.	Chlorine.	Total Solids at 105° C.	Solids after Ignition.	Loss on Ignition.	Phosphates.	Report.
1	Almonte, Ont	B.R., No. 1	Apl. 16	·155	·300	·514	2·0	117·6	63·2	54·4	Free	Suspicious.
2	"	B.R., No. 2	" 16	·610	·235	·708	1·5	120·8	63·2	57·6	V. h. traces.	Safe and wholesome.
3	Dunrobin, Ont	H.E.R.	May 6	·05	·16	4·83	120·0	484·8	332·0	152·8	Trace	Polluted.
4	Calgary, Alta	J.S.D.	" 10	·16	·06	·115	17·5	1132·0	980·0	152·0	"	Free from pollution.
5	Aylmer, Que	M.A.L.	" 10	·02	·11	·939	4·0	234·4	174·4	60·0	Trace	Safe and wholesome.
6	Miscouche, P.E.I.	R.G	" 11	Free.	·09	7·07	80·0	326·4	244·8	81·6	Free	Contaminated.
7	Westboro, Ont	J.K.	" 21	·11	·40	25·5	40·0	750·4	490·4	260·0	Trace	"
8	Sault au Recollet, Que	P.P.J.	" 22	·10	·21	18·92	57·0	620·0	493·2	126·8	L. traces	Seriously contaminated.
9	Vermilion, Alta	A.B., No. 1	" 28	·12	·20	·13	2·5	558·4	408·0	150·4	"	Decidedly suspicious.
10	" "	" No. 2	" 28	Free.	·25	Free.	3·0	386·4	228·0	158·4	Trace	Excellent, wholesome.
11	Vernon, B.C.	A.V	June 2	"	·04	·065	7·0	916·0	712·8	203·2	V. sl. traces.	Free from pollution.
12	Antigonish, N.S.	J.R.C.	" 2	·12	·08	Free.	100·0	2442·0	1908·0	534·0	Free	Seriously contaminated.
13	Ottawa, Ont.	C.E.F.	" 8	·01	·23	·107	20·8	94·0	73·2	20·8	...	
14	Fenelon Falls, Ont	W.B., No. 1	" 11	Free.	·165	11·06	22·0	464·8	401·2	63·6	Trace	Decidedly suspicious.
15	" "	" No. 2	" 11	·77	·09	·123	29·0	407·2	256·0	151·2	"	" "
16	Cypress River, Man.	W.N.S.	" 21	Free.	·14	Free.	28·0	2411·0	2005·0	406·0	"	Free from organic pollution.
17	Grondines, Que	E.H.G.	" 24	"	·09	2·47	22·0	258·8	204·4	54·4	"	Decidedly suspicious.
18	Woodroffe, Ont	J.M.R.	July 2	"	·02	3·78	4·0	278·0	219·6	68·4	Free	Suspicious.
19	Nepean Tp., Ont	A.T.S.	" 7	"	·06	·28	7·0	224·0	168·0	56·0	"	Free from contamination.
20	Oak Bay, N.B.	A.C.M.	" 22	·42	·135	1·55	70·0	339·6	263·6	76·0	Trace	Dangerously polluted.
21	Ayers Cliff, Que	H.J.L.	" 27	Free.	Free.	2·02	6·0	237·6	192·0	45·6	"	Excellent water.
22	Aylmer, Que	F.G.W	" 27	·06	·02	·065	12·0	408·8	252·8	156·0	None	Suspicions.
23	Woodroffe, Ont.	J.M.R.	" 29	·02	·04	5·28	7·0	326·0	211·6	115·2	L. traces	"
24	Folger Station, Ont.	A.T.S.	Aug. 9	Free.	·13	·181	4·0	240·8	166·4	74·4	S. traces	Safe and wholesome.
25	Massawippi, Que	K. & H., No. 1	" 9	·55	·22	·008	3·0	140·0	84·8	55·2	Trace	Free from contamination.
26	" "	" No. 2	" 9	·21	·18	Free.	Free.	241·2	167·2	74·0	"	" "
27	Hilliar, Ont.	S.N	" 10	Free.	·25	"	180·0	1219·2	887·6	331·6	"	Polluted.
28	Ottawa, Ont.	J.F.A.	" 10	·06	·36	·777	50·0	353·6	225·2	130·4	L. traces	Highly suspicious.
29	Dunham, Que	N.L.W	" 12	Free.	·030	·411	15·0	286·0	214·8	71·2	"	Contaminated.
30	Bridge End, Ont	P.D. McD.	" 17	·05	·16	·321	28·0	187·2	118·4	68·8	Free	Suspicious.
31	Arnprior, Ont	C.N	" 19	Free.	·28	·005	1·75	80·9	39·6	41·2	"	Wholesome.
32	Lemieux, Que	A.L., No. 1	" 21	"	·42	Free.	10·0	254·4	174·4	80·0	"	"
33	"	" No. 2	" 21	"	·435	"	67·0	570·0	406·0	164·0	"	"
34	"	" No. 3	" 21	"	·30	1·06	47·0	328·0	219·0	109·0	"	"
35	"	" No. 4	" 21	"	·34	Free.	13·0	200·0	135·0	65·0	"	"

ANALYSES OF WELL WATERS, 1909-10—*Concluded.*

RESULTS STATED IN PARTS PER MILLION.

Number.	Locality.	Marks.	Date.		Free Ammonia.	Albuminoid Ammonia.	Nitrogen in Nitrates and Nitrites.	Chlorine.	Total solids at 105° C.	Solids after Ignition.	Loss on Ignition.	Phosphates.	Report.
36	St. Hyacinthe, Que.	F.E.	"	26	120·0	·22	·0329	150·0	657·6	518·4	139·2	Trace	Suspicious.
37	Hampton, N.B.	E.C.H.	Sept.	2	·08	·10	2·46	6·0	81·6	60·0	21·6	V. sl. traces.	Highly suspicious.
38	Westmoor, Sask.	H.B.	"	16	4·14	·49	1·15	70·0	4226·0	3324·0	902·0	Free.	Saline.
39	Shanly, Ont.	Rev. W.K.	"	17	·15	·135	·99	22·0	546·0	360·0	136·0	....	Contaminated.
40	Moncton, N.B.	W.C.	"	18	·02	·06	7·59	30·0	394·0	240·0	154·0	....	Suspicious.
41	Britannia, Ont.	J.M.R.	"	23	Free.	·09	Free.	4·0	240·0	176·0	64·0	....	Wholesome.
42	Vernon, B.C.	E.B.	"	25	·16	·07	·082	1·0	516·8	474·4	42·4	V. sl. traces.	"
43	Rideau River, Ont.	O.M.I.	"	27	Free.	·74	·032	8·5	120·0	75.2	44·8	"	Contaminated.
44	Ottawa East, Ont.	O.M.I., No. 1.	Sept.	27	Free.	·04	5·42	44·0	400·0	280·0	120·0	V. sl. traces.	Very suspicious.
45	" " "	" No. 2.	"	27	1·24	·16	·89	8·0	260·0	210·4	49·6	"	Suspicious.
46	Westport, N.S.	C.G.	"	27	Free.	·09	2·4	40·0	160·0	117·6	42·4	"	Very suspicious.
47	Lloydminster, Alta.	W.H.H.	"	29	·14	·30	Free.	60·0	2862·0	2182·0	699·2	"	Saline.
48	Ottawa, Ont.	S.M.L.Co.	Oct.	14	Free.	·08	·741	Free.	134·8	103·2	31·6	"	Wholesome.
49	Elstow, Sask.	J.R.	"	18	1·06	·15	Free.	150·0	4308·8	3452·4	856·4	Trace.	Saline.
50	Tate, Sask.	H.C.F.	Nov.	1	Free.	·13	·609	43·0	2316·0	1806·4	509·6	Free.	"
51	Middle Simonds, N.B.	C.R.	"	26	"	Free.	·623	2·0	149·2	128·8	20·4	Trace.	Wholesome.
52	Westboro, Ont.	F.W.H.J.	"	26	"	·04	6·19	6·0	284·8	222·0	62·8	"	Unpolluted.
53	Sault au Recollet, Que.	M.W.	"	30	"	·255	Free.	2·0	70·0	24·0	46·0	Free.	Wholesome.
54	Almonte, Ont.	B.R., No. 1.	Dec.	4	"	·11	·082	2·0	97·6	64·4	33·2	Trace.	Unpolluted.
55	" "	" No. 2.	"	4	·07	·28	·024	5·0	124·4	66·8	59·6	"	"
56	City View, Ont.	S.A., No. 1.	"	17	Free.	·09	4·90	40·0	274·4	206·4	68·0	Free.	Highly suspicious.
57	" "	" No. 2.	"	17	"	·11	10·32	40·0	516·8	364·0	152·8	"	" "
58	Letellier, Man.	N.B.	Jan.	7	·64	·18	3·85	60·0	736·0	574·4	161·6	L. traces.	Contaminated.
59	Algonquin Park, Ont.	J.F.A.	"	7	·35	·68	Free.	1·0	38·0	12·0	26·0	V. sl. traces.	Free from drainage pollution.
60	Watford, Ont.	J.D.C.	"	19	Free.	·135	1·05	11·0	338·0	284·0	54·0	Trace.	Suspicious.
61	Renfrew, Ont.	E.J.McV.	"	24	"	·12	Trace.	Free.	38·0	16·0	22·0	Free.	Wholesome.
62	Hoasic, Ont.	R.S.W.	"	31	"	·09	3·62	3·0	357·6	297·6	60·0	Trace.	"
63	Copetown, Ont.	F.B.H.	Feb.	2	·13	·07	6·19	45·0	530·0	366·0	164·0	"	Highly suspicious.
64	Kelowna, B.C.	LeR.D.	"	9	Free.	·05	Free.	2·0	139·2	70·0	69·2	"	Pure and wholesome.
65	Wadina, Sask.	J.T.	"	10	·06	·11	·164	14·0	1588·8	1298·8	290·0	"	Saline.
66	The Brook, Ont.	A.C.	"	16	8·49	·23	·42	4400·0	13517·6	7420·0	6097·6	"	"
67	Elm Creek, Man.	P.D.A.	"	21	1·14	·13	Free.	720·0	3384·8	2600·8	784·0	L. traces.	"
68	Huntingdon, Que.	R.J.S.	"	25	·87	·11	3·41	37·0	533·6	398·4	135·8	Trace.	Suspicious.
69	Cummings' Bridge, Ont.	C.P.	Mar.	8	1·57	·78	Free.	281·0	1222·4	1117·6	104·8	"	Highly suspicious.

70	South Melfort, Sask.	J.T	"	11	·09	·20	·70	11·0	4491·2	3783·2	708·0	Free.	Saline.
71	Williams Siding, B.C	Ch.G.	"	12	·15	·195	·04	·6	72·0	54·2	17·8	"	Suspicious.
72	Sidney Crossing, Ont.	A.R.B.	"	19	6·60	·435	2·449	5600·0	11412·0	9416·0	1996·0	"	Saline.
73	Summerland, B.C.	S.P	"	21	·04	·25	Free.	6·0	258·4	219·2	39·2	"	Not contaminated.
74	Maniwaki, Que.	J.L., No. 1.	"	24	·010	·170	·733	2·0	113·6	86·4	27·2	"	" "
75	" "	" No. 2.	"	24	·010	·540	1·277	2·0	169·6	120·8	48·8	"	Suspicious.
76	Penticton, B.C.	E.F.B.	"	28	·240	·140	4·052	3·0	90·0	78·0	12·0	"	"
77	Granum, Alta	A.W.D	"	28	·300	·110	2·200	115·0	2502·4	2489·6	12·8	"	Saline.
78	Shadeland, Man	L.Bros	"	28	·5·260	·460	1·696	520·0	8097·0	7751·0	346·0	"	"
79	Grondines, Que.	E.H.G.	"	30	·160	·120	·962	101·0	708·8	589·6	119·2	"	Suspicious.

REPORT OF THE ENTOMOLOGIST

C. GORDON HEWITT, D.Sc.

OTTAWA, March 31, 1910.

Dr. WILLIAM SAUNDERS, C.M.G.,
Director of the Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith the report of the work of the Division of Entomology, with an account of some of the more important insects and pests that occurred in Canada, and concerning which advice was given during the year ending March 31, 1910.

The year has been one of importance and interest for these reasons: it is twenty-five years since my predecessor, the late Dr. James Fletcher, was appointed Dominion Entomologist to the Department of Agriculture, and two years later he was permanently and officially attached to the Department on the establishment of the Experimental Farms in 1887. Owing to the rapid agricultural progress and activity and his indefatigable energy, the entomological and botanical work together became far too great for the direction of a single officer. The need for further development of entomological work and investigation, and the increasing demands for advice, in addition to the increase of other duties of an administrative and executive character, necessitated the separation of the entomological and botanical work and the formation of a separate Division of Entomology. This change was effected during the present year, and, having been appointed in May to take charge of the work, I arrived in Canada on September 16, 1909. The major portion of my time during the ensuing six months has been occupied in the equipping and organizing of the work of the new Division. Three rooms have been provided, and the two larger of these have been furnished and equipped as entomological laboratory and museum respectively, and the third is occupied by me. It has been necessary to make use of a fourth room for the carrying on of breeding and other experiments, and there is a pressing need for accommodation for this work which is the most important branch of the work of the Division.

In equipping the Division, the primary object has been to provide facilities and means for the prosecution of investigatory work. The need of such work is urgent, as we are being confronted annually with fresh problems which can be elucidated only by the careful study of, not only the life-histories of insects, but also their bionomics. In Canada especially, with its varying climates, as complete a knowledge as possible of the factors affecting the lives and habits of injurious insects is a *sine qua non*. We need to know the effect of extreme cold, for example, on certain species of insects in order to be able to determine the possible distribution of such insects. A further field of investigation to which attention must be given is that of parasitism. The importance of a more thorough knowledge of the parasites affecting, not only injurious insects, but also native insects is being realized by entomologists. In many instances we are compelled to rely on such natural means of control as these parasites, belonging to different classes of insects, and also on parasitic fungi. In the work of con-

trolling the Gipsy and Brown-tail moths in the New England States, upon which more than a million dollars is being spent annually and to which the State of Massachusetts is devoting more than one-tenth of its annual budget, the chief means by which control will ultimately be established will be undoubtedly by parasites, and upon the study, importation, breeding and distribution of the different parasites of these two insects, several hundred thousand dollars are being expended each year—indicating from a monetary point of view alone the importance of this means of control. A knowledge of the relation of birds to the agriculturist and horticulturist, as regards their utility and otherwise as natural means of control of insect pests, is greatly to be desired. Owing to the absence of any accurate data of value on this subject in Canada there is a danger of the destruction, through ignorance, of species which may be useful to the farmer and fruit grower and, until such data have been collected by actual analysis of the contents of the stomachs of birds, no statements of value can be made as to the economic worth of any but purely insectivorous birds.

The work of the Division at present falls under a number of heads. The greater portion of the time of the officers is occupied in the identification of injurious and other insects sent in by correspondents in the various provinces of the Dominion, and the giving of advice as to the treatment of these pests. Whenever it is necessary or desirable the insects are studied. In addition to these investigations that are continually being made, it is intended to make a study of certain problems which are at present requiring attention. The Brown-tail Moth (*Euproctis chrysorrhœa, L*) will be studied in reference to conditions in Canada. A study of the Larch Sawfly (*Nematus erichsonii,* Hartig.), which I began in England, is being continued with especial reference to its European and American parasites. Mr. Gibson is continuing his work on the larvæ of the Noctuid moths, many of which, under the popular name of 'cutworms,' are responsible for enormous losses at times; consequently a study of the life-history and bionomics of all the forms that it is possible to obtain is of very great importance, as the possession of such knowledge is oftimes of value, inasmuch as it not infrequently happens that, when land is cultivated, species hitherto uninjurious become pests. Further experiments on the control of those injurious insects, the Root-Maggots, will be carried out. A number of other important lines of investigation, many of which are urgent, will be followed as opportunities are offered.

During the past few months a new 'Destructive Insect and Pest' Bill has been introduced. The necessity for such legislation is extremely pressing. With the rapid development of all forms of rural activity, and the importation of vegetation of all kinds from other countries, we are exposed to the grave danger of the introduction of serious insect and other pests. As examples of such introduced pests it is only necessary to refer to the San José Scale and the Brown-tail Moth, than which no more serious fruit pests occur. There was already in existence the San José Scale Act passed in 1898, with subsequent amendments, under which regulations were made for the fumigation of all nursery stock likely to be infested with the scale, and the fumigation stations at six ports of entry were established. Such regulations, providing for fumigation only, were totally inadequate to meet the requirements of present conditions, and in view of this the Hon. the Minister of Agriculture introduced the new Bill. Briefly, it provides for fumigation against the San José Scale and Woolly Aphis; the inspection of imported nursery and other stock that is liable to be infected with serious insect pests such as the Brown-tail and Gipsy Moths, and the power of inspection of orchards and other lands or premises which it may be deemed advisable to inspect for those insects and other pests scheduled as serious. On the appearance or threatened appearance of an insect pest dangerous to agriculture, horticulture or forestry, it will be possible for the Hon. the Minister of Agriculture to issue such regulations as shall enable him to take the necessary precautionary or eradicative steps. It also makes provisions for the granting of compensation by the Minister for vegetation, &c., destroyed in pursuance of the regulations.

The Brown-tail Moth is still the most serious entomological problem with which we have to deal. Towards the end of March I visited those districts in Nova Scotia where the insect has been established and exists at present, to gain a complete idea of the nature of the infestation. During this visit, I addressed several public meetings in the infested region and impressed the seriousness of the infestation upon the people, many of whom, owing to their ignorance as to the facts, which was only natural, had been somewhat indifferent. With the means at their disposal, the provincial authorities under Mr. M. Cummings, the Secretary of Agriculture for Nova Scotia, have carried on an excellent campaign against the insect and too much stress cannot be laid on the importance of such eradicative measures in the early stages of the infestation. In our campaign against the Brown-tail Moth we may profit by the painful experience of the State of Massachusetts. In 1890, they began exterminative work against the Gipsy Moth which had increased enormously since its introduction in 1869 and was inflicting most serious damage in the State. This work was energetically continued for ten years and by 1900 the moth had been reduced to such an extent that it was doing no serious damage and, in fact, had been exterminated in many localities. Most unfortunately, the State discontinued operations and in a few years the insect increased to such an enormous extent and spread over so wide a territory, that now, with the Brown-tail Moth, it is entailing an expenditure of over a million dollars annually. It is necessary, therefore, that every means possible should be taken to prevent the spread and obtain control of this insect in Canada or it will be impossible to estimate the financial loss and physical suffering which its presence will entail. This season the inspection of European nursery stock imported into Canada is being continued and already a large number of the winter nests of the Brown-tail Moth have been discovered on French nursery stock, but, as the inspection will continue until May, the results cannot be given in this report.

I am pleased to say that there have been no serious outbreaks of insects injurious to cereals which form the staple results of agricultural activity in Canada. White Grubs and Wireworms have caused serious damage to potato crops in certain regions and methods of combatting these are considered below. A slight spreading of the San José Scale has occurred, but it is believed and hoped that the means that the Department of Agriculture of Ontario are adopting for dealing with this insect will be effectual.

In July, a serious outbreak of the Spruce Budworm (*Tortrix fumiferana* Clemens) was investigated and reported upon by Mr. Gibson. Certain species of bark and timber boring beetles are causing much damage, especially to coniferous forest trees, and it is extremely desirable that a knowledge of these should be gained, especially on account of its important relation to the question of the conservation of our forests.

In addition to the above work, great use is made of the Division by entomologists and collectors in different parts of Canada who send in specimens and collections for identification. By means of our own collections and with the help of specialists in Canada and the United States, for whose assistance I wish to express my sincere thanks, especially to Dr. Howard, Entomologist to the United States Department of Agriculture, we are able, not only to render this useful assistance, but also to acquire knowledge which is frequently of importance to the work of the Division. The entomological collections of the Division are being arranged with a view to making them as useful as possible to the student, the teacher and also the general public. For the general public and for lecturing purposes, exhibits of typically injurious insects, their life histories and injuries are being arranged. In the absence of a national collection of Canadian insects, every endeavour is being made to render the systematic collections as complete and representative as possible.

The supervision of the orchards on the Indian reserves in British Columbia, on behalf of the Department of Indian Affairs, with a view to the eradication of the

pests occurring there, has continued, and the work of spraying, pruning and cleaning cut has been carried on by Mr. Tom Wilson. It is a great pleasure to find that our efforts to inculcate better horticultural methods amoug the Indians are not only meeting with some success, but are also giving satisfaction to the fruit-growers and settlers who previously complained about the state of the Indian orchards.

Shortly after taking up my duties, I left Ottawa on October 3 for British Columbia to inspect the western fumigation stations and the Indian orchards, and also for the purpose of inquiry in connection with the work of the Division. The Experimental Farms at Brandon, Indian Head and Agassiz were visited, and I returned on October 26. The annual meeting of the Entomological Society of Ontario at which I delivered the public address, was attended in November, and from this meeting I went to Niagara Falls and Windsor, Ont., to inspect the fumigation stations at these points. The fumigation statious at St. John, N.B., and St. John's, Que., were inspected on November 18 and 19. On December 9 an address on 'Fruit Pests' was delivered at the annual meeting of the Pomological Society of Quebec at Macdonald College, Que. The meeting of the American Association for the Advancemeut of Science held at Boston during the last week of December was attended, including the meetings of the Entomological Society of America and the Association of Economic Entomologists, a paper on the Larch Sawfly being read at the latter. Addresses have also been delivered before the Commission of Conservation aud also at Truro, N.S., and other places on various classes of injurious insects and their control.

I should like to take this opportunity of acknowledging the services of, and my indebtedness to, my Chief Assistant, Mr. Arthur Gibson, who carried on the work of the Division from the beginning of the year until my arrival in September, that is, for the first six months and also during my absence from Ottawa at various times. Mr. R. C. Treherne, B.S.A., is inspecting European nursery stock for the Brown-tail Moth, and Mr. J. A. Letourneau, in addition to the secretarial work which he has efficiently carried out, has begun a catalogue of the entomological publications of the library of the Division, which has been considerably increased by the purchase of the library of the late Dr. Fletcher and of a number of standard works and additional periodicals.

The work of the Division is increasing annually, but especially during the last year, owing to the measures that are being taken against the Brown-tail Moth. It is of the greatest importance, however, that the more important work of investigation should not be hindered owing to the natural increase of duties of an executive character, otherwise progress in our knowledge of the problems awaiting solution will not be made, and the work of the Division cannot attain such a scientific character as is essential, if it is to be of the greatest practical value to Canada.

I have the honour to be, sir,

Your obedient servant,

C. GORDON HEWITT,

Dominion Entomologist.

DIVISION OF ENTOMOLOGY.

Every year complaints are made concerning the injuries to field and root crops caused chiefly by two species of insects, namely, White Grubs and Wireworms. In many cases these injuries might have been prevented or reduced had the farmers and others been in possession of the following facts. White Grubs and Wireworms generally occur in old pasture or grass land. Their presence is not usually noticed unless their injuries are severe, as in the cases mentioned later. This is doubtless owing to the fact that grass land does not receive so careful scrutiny as a crop. When such land is turned down and put under cultivation, the subsequent crop is usually sown at once; not infrequently potatoes are planted, with the result that these insects, supplied with new food very much to their liking, cause considerable damage. It is necessary, therefore, for farmers to bear these facts in mind and, on putting old grass or pasture land under cultivation, to adopt such means of cultivation as are recommended in order to avoid the possibility of serious injuries to their crops by these insects, which, owing to their peculiar life histories and habits, cannot be controlled on a large scale by other means. It will be found that where a regular rotation of crops is practised and land is not left under grass for more than two or three years, White Grubs and Wireworms will be considerably less injurious, and from the point of view of crop production, such rotations are to be recommended.

During the year the White Grub has been one of the most injurious insects. This insect has been extremely plentiful, especially in the eastern provinces of the Dominion, and in every occurrence it was reported to be very injurious. In many counties in Ontario and also in Quebec and Prince Edward Island, potatoes were severely attacked; in some cases they were not worth digging and 12 to 15 grubs were to be found in a single hill. In Middlesex, Ont., grass-land was so severely attacked that the top could be rolled off perfectly dead, and one correspondent collected four quarts of the grubs, which were only about one-third of those present, in a tenth of an acre. In Ontario, Quebec and Nova Scotia they were injurious to strawberries and to corn which had been planted on the sod in Ontario.

The White Grub is the larva of a fairly large and robust brown beetle which, as it appears in these regions in June, is called the June Bug; further south they appear earlier and are known as May Beetles. These beetles, usually species of *Lachnosterna*, feed on the foliage of certain trees such as oak, maple, poplar, chestnut, &c., and are sometimes the cause of no little injury to such hardwoods. They deposit their eggs singly in the ground at a depth of one to several inches and the young white grubs or larvæ on hatching out feed on the young roots of the grass or crop which they are attacking. The approach of winter causes them to work their way deeper into the soil where they hibernate. They usually remain three seasons in the grub stage, hibernating each winter except the last, before which the grubs usually change into the pupal stage, and from this into beetles, and the mature beetles hibernate to emerge the following year. The greatest damage is done by the grubs in the second and third years of their growth when they feed on the larger roots. It should be pointed out, however, that our knowledge of these insects and their life histories is comparatively meagre. The remedial treatment are still, as a rule, in the unsatisfactory state of being suggestive.

DIAGRAM OF LIFE HISTORY OF THE WHITE GRUB. *(Lachnosterna sp.)*

1910.		1911.		1912.		1913.
Summer.	Winter.	Summer.	Winter.	Summer.	Winter.	Summer.
Eggs laid, Grubs hatch and begin to feed.	Grubs hibernate.	Grubs feed.	Grubs hibernate.	Grubs feed and change into Pupæ, from which Beetles emerge in a few weeks.	Beetles hibernate.	Beetles emerge and lay eggs.

As the White Grub passes all its life underground it is almost impossible to control it by ordinary measures. In cases where small areas of grass are attacked, drenching the affected area with kerosene emulsion is sometimes effective. Where larger areas are attacked, methods of cultivation only can be relied upon. Deep ploughing in the fall will bring up large numbers of the hibernating grubs and expose them to climatic influences such as frost, &c. If possible, this should be repeated a second year and cross-ploughing is to be recommended if the infestation is severe. Hogs or poultry turned on the ploughed land will destroy large numbers of the grubs. Such crops as cereals and roots should not be sown on infested land, but clover, which appears to be more immune, may be sown on the land and then ploughed under in the following fall. Two fall-ploughings with an intermediate crop of clover will expose and destroy very many of the White Grubs in their different stages. It is impossible on account of the prolonged life history, extending as it does over several years, to rid infested land of these insects by measures carried out for one year only; repetition is necessary to destroy those larvæ which have escaped the previous year's treatment. In Europe, the destruction of the adult beetles, which can be effected by collecting them or by spraying the infested trees with au arsenical spray has been found to be of great service in reducing the infestations.

WIREWORMS.

As in the case of White Grubs, these insects are found frequently to attack crops of cereals or roots which have been sown in permanent grass land newly turned under cultivation, owing to the fact that their normal habitat is grass land, where they live feeding on the roots. Potatoes are often sown as the first crop, and, in consequence, the majority of complaints that are received are of injuries to potatoes in the different provinces from Nova Scotia to British Columbia. In Ontario, it was the chief insect of which complaints were received as destroying new fall wheat, and in Nova Scotia it destroyed corn which had grown about two feet in height.

Many remedies have been suggested for Wireworms and much disappointment has resulted from their trial, with no little loss of time, money and faith. The wireworm is the larva of a beetle known as the 'click-beetle,' of which there are a number of species. The beetle is rather long compared with its breadth, brown in colour and has the habit, when laid on its back, of jumping into the air with a click and righting itself. The Wireworms are about an inch or an inch and a quarter long when full grown, of a light brown or brownish yellow colour and have three pair of legs at the anterior end. These characters distinguish them from the millipedes mentioned later, which are often mistakenly called Wireworms. Their life history, like that of the White Grub, is a lengthy one and the 'worm' or larval stage may last

two, three or four seasons according to the species of Wireworm and also according to conditions of climate and soil. After its lengthy life, the 'worm' changes into the pupa at the end of the summer and in two or four weeks the pupa changes into the adult beetle which hibernates until the following spring when it emerges to lay its eggs. At Ottawa, adults were seen flying on sunny mornings of the last week in April. It is customary, therefore, to find Wireworms of different ages in the soil, and these pass the winter in this situation. Consequently, the best method of treatment, as in the case of the White Grub, is one of cultivation, and the greatest benefit can be obtained by adopting the same measures, namely, deep ploughing in the fall to expose the larvæ and pupæ. Clover or buckwheat may be sown on grass land which has been turned down to cultivation if it is not desired to leave the land under summer-fallow which is the procedure to be most recommended; but a clean fallow is not always successful. On account of the hard and resistant nature of the Wireworm and its position during life it is almost impossible to treat it with insecticidal substances and these are not to be recommended. Penning sheep on grass land intended for cultivation is sometimes attended with good results as the sheep tread the soil down firmly and prevent the movement of the Wireworms, and by heavily manuring the land. make it unattractive to the beetles. It has been frequently recommended to dip the seeds or grain in certain preparations or chemicals before planting in order to prevent tho attacks of Wireworms. Careful investigations into these methods and remedies have shown that, as a rule, they are useless, and to adopt such methods is a waste of time and money. It is evident that the fact of the grain being coated with a poisonous substance will not prevent the Wireworm from eating the young roots, which are of course not poisoned, as is its custom, and thus killing the young plant.

ROOT MAGGOTS.

From year to year, the attacks of these insects appear to assume greater proportions and from all provinces the injuries of the different species to roots and other field and garden crops are reported, many of these reports indicating the serious nature of the injuries, and the aggregate loss due to these insects alone must be very great. In the vicinity of Edmonton it is said to be extremely difficult to grow onions on account of the Onion Maggot (*Phorbia ceparum* Meig). In the same district the Cabbage Root Maggot (*P. brassicæ* Bouché) destroyed early cabbages and cauliflowers. One correspondent planted about 2,000 late cabbages and large numbers of the eggs were seen round the stems of nearly all. In Ontario, cabbage, radishes and cauliflowers were attacked. A correspondent at Munro, B.C., had most of his turnips killed when quite young; when the remainder were harvested it was found that the portions of the turnips underground were masses of maggots. These insects have now appeared so far uorth as the Yukon territory where their presence was unknown a few years ago, but they were reported during the past year as attacking turnips, radishes and onions.

THE CABBAGE ROOT MAGGOT *(Phorbia brassicæ)* and the Onion Maggot (*P. ceparum*) have been responsible for the most of the injuries reported to the Division. The Seed Corn Maggot (*P. fusciceps* Zett.) is not infrequently responsible for serious injuries to Indian corn and beans in Canada.

When studying the breeding habits of an allied species, (*Anthomyia radicum* L.) in England a few years ago, it was found that the female flies were attracted to manure in which they laid their eggs and the larvæ or maggots developed in the manure. This explains a fact which is frequently noticed, namely, that root maggots are more numerous and injurious on land which has either been freshly manured or heavily manured, and the number of instances of the influence of stable manure

in attracting the flies and serving as additional food for the maggots have come to my notice. The flies into which these maggots develop are somewhat similar in appearance to small house-flies, and they lay their eggs round the bases of the young plants early in the summer, the worst damage being usually experienced in June and July. Vegetables which are planted early withstand the attacks of the maggots better than those planted later, which sometimes appear quite healthy one day and are withered the next. Mr. Fyles states that radishes sown at Quebec in the beginning of May are a success; radishes sown at Ottawa in May are attacked. The development of these insects may be complete in two or three weeks and there are a number of broods during the season, the injuries becoming more serious with the increase in the numbers of the flies. The winter is passed in the brown pupal stage.

As these insects are becoming so seriously troublesome in Canada, it is important that farmers and others should he familiar with those measures by the application of which benefit has been derived in the prevention, control and eradication of tbe different species of root maggots. It should be remembered that the value of a particular measure depends on a number of natural factors such as locality, climatic conditions, nature of crop, &c., and a remedy which may he effective one year may not give the same results in the following year.

TARRED PAPER CARDS.

The method of control which has proved most successful in the protection of cabbages and cauliflowers from the attacks of the Cabbage Root Maggot, and at the same time very cheap, is Goff's tarred paper card device. The principle of this method is the surrounding of the stem of the transplanted seedling with a tarred paper card which closely encircles the stem of the plant and lies flat on the ground; by this means the female flies are prevented from laying their eggs at the base of the stem of the cabbage or cauliflower. If this method is continued for several years it will be found to be the best protection against the Cabbage Root Maggot. The tarred paper cards are cut out by means of a special tool shown at A in Figure 1. This must be carefully made by a blacksmith, and the cutting blade consists of a half hexagon, from one corner of which the blade passes to the centre and finishes in a star-shaped stud which makes the star-shaped cuts in the centre of the card. The edge of the tarred paper is first cut into the shape shown in Figure C by using one angle of the tool only. The complete cards are now cut out by beginning on the left-hand side and placing the blade of the cutting tool as indicated by the dotted lines; in this way, by tapping the handle of the cutting tool with a mallet, a complete hexagonal disc similar to B is struck off and this process is continued across the paper. In each line there will be a certain portion of the paper left over in cutting the hexagons. When the seedlings are transplanted the cards are placed round their bases by opening the slit and slipping it round the stem which passes through the star-shaped cut in the centre of the card. It is extremely important to place these cards on the plants correctly, as carelessness in fixing them will render them useless. The card should fit tightly round the base of the stem of the plant and should be perfectly flat upon and close to the ground, as shown in Figure D. Figure E shows how the cards should *not* be applied. If the soil is inclined to be rough or lumpy, it should be rolled before the planting of the seedlings in order that the cards may lie flat on the ground and fit well round the bases of the seedlings. In practice, this has been found to be the cheapest and most effectual method yet devised. It is not possible to use this method against the root maggots attacking such vegetables as onions, radishes or turnips, and for these the carbolic emulsion may be used, as it has been found effectual and is cheap, although in certain cases it is not infallible; Slingerland's formula is; 1 lb. of hard soap or 1 quart of soft soap dissolved in a gallon of boiling water, a pint of *crude* carbolic acid is then added and the whole is agitated into an emulsion which

will keep for some time. One part of this is diluted with thirty to fifty parts of water. It should be applied early, when the plants are coming up. The roots of seedlings to be transplanted should be dipped in the emulsion, and then the bases of the plants should be watered well with the emulsion every week or ten days. Watering the plants about once a week with a decoration of hellebore, using two ounces of hellebore to one gallon of water, will give good results in the case of radishes.

Where small plots of cabbages or other vegetables are growu, they may be protected from the Root Maggot flies by coveriug the plants early in the season with cheese-cloth screening stretched over frames. The lower edges of the cheese cloth should be spread a little on the ground and covered with earth to prevent the flies from creeping under. Some growers might find it economical to prepare frames covered with a weather-resisting, bronze wire fly screen. The injection of carbon bisulphide near the bases of the plants has been found effective in the destruction of the maggots.

Particular attention should be paid to methods of cultivation. Weeds belouging to the same family of plants as the cabbage, namely the Cruciferæ, such as wild mustard, &c., should be destroyed; but, in good farming, this applies to all weeds. Deep ploughing in the fall would tend to bury many of the pupæ, in which stage the winter is passed, too deep in the soil for the emergence of the fly in the following year.

APHIDES AND SCALE INSECTS.

The season of 1909 was an exceptional one in Canada for the abundance of the different species of aphides or plant lice and also the allied scale insects. This was also the experience in the United States and in Englaud. Our knowledge of the bionomics of these insects is, as yet, insufficient to enable us to explain this abnormal abundance, but observations on the reproduction of aphides suggest a possible explanation. The abundance of aphid life is dependent upon the rate of reproductiou of aphides, and this, I have found in a number of cases studied, is dependent on the amount of sap present on the trees or plants upon which they are feeding. A large amount of sap, in other words an abundance of food, encourages growth and reproduction. The amount of sap in most plants is dependent primarily upon the rainfall and such meteorological conditions as the humidity of the atmosphere. A study of the records shows that the rainfall of the spring and summer of 1909 was considerably higher than the normal; the temperature of January, February and March was higher than usual, the winter being favourable for trees, and, notwithstanding a wet and backward spring, the month of June was noticeable for the luxuriant growth of vegetation, the luxuriance of which was maintained by the heavier rainfall of the succeeding months. Such conditions, and the lack of sufficient numbers of parasitic and predaceous enemies may account, I think, for the abnormal abundance of aphides in certain years. The importance of knowing these conditions with certainty is very great, as, when that is accomplished, it will be possible, to a great extent, to predict the abundance or scarcity of aphid life and to act accordingly.

The rapid rate at which aphides are able to reproduce is due to two facts: first, that they are able to reproduce parthenogenetically; that is, an unfertilized female is able to reproduce; secondly, such a female produces living young instead of eggs. These females, therefore, are able to produce large numbers of their kind which in turn are themselves able to reproduce in like manner in the course of a few days.

The different species were very abundant in the early part of the year on herbaceous plants, trees, conifers, cereals, &c. Fruit trees suffered considerably from the Apple Aphis which largely ruined good crops in certain localities; the Plum Aphis and, in British Columbia, the Cherry Aphis, were abundant. The life history of a typical aphid or plant louse is briefly as follows: The winter is passed in the egg stage and

the eggs may be found often in large numbers on the twigs of the trees, those of the Apple Aphis being shiny, black, oval bodies. In the spring, usually when the buds are opening, the eggs hatch and the minute plant lice make their way into the unfolding leaves where they immediately begin to suck the sap from the tender foliage and soon grow to their full size. These individuals now begin to produce living young ones and this continues from generation to generation during the summer, these generations being wingless. In some species complications are introduced owing to the fact that a winged generation is produced which migrates to a different host plant and there continues the life history of the species; in some cases the egg stage and spring generation is passed on plants of a woody character and the early summer generation migrates to some crop which dies down in the winter. The Hop Aphis (*Phorodon humuli* Schrank) passes the summer on the hop, but winged forms migrate to the plum (including wild plum) in the fall and from these, sexual forms are produced which deposit eggs on the twigs of the plums from which the spring generations are produced. In the fall, this production of living young by virgin females ceases and sexual forms, males and females, are produced which may or may not be winged—the males are usually winged. These sexual and fertilized females deposit the winter eggs. The remedies for aphides are winter spraying with lime washes or lime-sulphur and spring spraying with kerosene emulsion. The method of preparing these insecticides is given under the description of the Oyster-shell Scale. For a summer spray, it is difficult to find a more effective and cheaper spray than the home-made tobacco decoction. The tobacco can be grown and dried at home and an excellent contact spray for aphides is made by soaking for several hours one pound of this tobacco, or two pounds of tobacco stems or dust in four gallons of water which is almost boiling and applying the solution warm. The *water must not be boiled after the tobacco has been immersed;* it should be kept hot but not boiled or the nicotine will begin to volatilize.

The Woolly Aphis of the Apple (*Schizoneura lanigera,* Hausm) appears to be increasing, having been recorded from Ontario and Nova Scotia. Fruit growers should take all measures possible to eradicate this most serious pest which is especially insidious as it attacks the roots of the tree in addition to the branches, and the root form, once established, is difficult to eradicate. The aerial form of the Woolly Aphis may be treated in the same manner as other aphides, but it is necessary to adopt special measures to eradicate the root form. All nursery stock should be most carefully fumigated or dipped in kerosene emulsion before being planted; this will prevent its introduction on nursery stock, which is a common means of distribution. If the branches or twigs are attacked by Woolly Aphis, it is very probable that the root form occurs also and treatment should be adopted accordingly. Remove the soil to a depth of four to six inches round the base of the tree to a distance of about two feet from the crown, the ground and roots should now be drenched with a strong solution of kerosene emulsion or with a strong decoction of tobacco. The use of dry tobacco ash has also been found effectual. Another method may be used if the soil is dry and not too heavy; namely, the injection of carbon bisulphide into the ground about 18 inches from the crown of the tree, taking care not to touch the roots. This liquid volatilizes and the gas, which is poisonous to insect life, percolates through the soil.

In certain cities, such as Toronto and Quebec, the elms have been attacked by the Woolly Elm Bark Aphis (*Schizoneura rileyi* Thomas).

The Woolly Aphis of the Alder (*Pemphigus tessellata* Fitch) was very common and specimens collected near Ottawa in September were being preyed upon by the caterpillar of the little orange butterfly called 'The Wanderer' (*Feniseca tarquinius* Fabr.).

The Oyster-shell Scale (*Lepidosaphes ulmi* Linn.) or, as it is sometimes wrongly called the Oyster-shell Bark Louse, which name rightly belongs to another scale insect (*Aspidiotus ostreæformis* Curtis), is increasing in most of the provinces; in Ontario it has become a serious pest and appears to be doing as much damage as the San José Scale and Codling Moth as it occurs in almost every orchard. This increase is due largely to neglect on the part of many fruit growers who own but a few, usually old, trees which are not infrequently covered with scale. During the winter the scale, which resembles somewhat the shape of a blue-point oyster, acts as a protective covering for the yellowish-white egg, which may number as many as 80 under a single scale. The eggs hatch in May and June and the young six-legged larvæ creep out and seek a fresh site where they soon settle down and form a protective scale under which they live, feeding on the sap of the tree and, after laying their eggs at the end of the summer, they die. Most of the individuals are females and these are wingless; the males are winged and rare. The following methods of eradication may be employed:—

1. The trees should be sprayed shortly before the buds open in the spring with either a simple lime-wash (using about 1½ pounds of lime to a gallon of water), or lime-sulphur. The lime-wash is effective partly owing to its caustic action and partly by preventing the emergence of the young larvæ. As in all such spraying, the whole of the tree including the ends of the twigs should be well covered with the spray solution. The home-boiled lime-sulphur wash is preferable to the commercial lime-sulphur for this spring spraying of dormant trees and is made in the following manner:—

Unslaked lump lime, 20 lbs.; sulphur, 15 lbs.; water 45 gallons. Slake the lime with warm water and while it is boiling hot add the sulphur and stir thoroughly. The whole is now boiled steadily over a fire, or by means of steam, adding more water when necessary until the mixture is of a deep reddish brown colour. Sufficient water should be added to make it up to 45 gallons and after a few minutes further boiling the solution should be strained and applied as warm as possible. If it crystallizes, it will be necessary to reboil. Very bady infested trees should have an extra spraying in the fall. If the trees are thoroughly and regularly sprayed each year with lime or lime-sulphur, this and other scales will be eradicated and the trees will be kept clean.

2. A careful watch should be kept for the emergence of the young larvæ and as soon as they appear, as yellowish white specks crawling about on the bark, the trees should be sprayed with kerosene emulsion. Kerosene emulsion is made as follows:—

Kerosene (coal oil), 2 gallons; whale-oil soap, ½ lb.; soft water, 1 gallon. Dissolve the soap by boiling in water. While the solution is boiling hot, take it away from the fire and pour it into the kerosene. The solution is now violently churned and agitated for about 5 minutes to form a emulsion. This is the stock solution, and, if well made, will keep. In the summer, use it in the proportion of one part to 10 or 12 parts of water. For winter use and for the root form of Woolly Aphis, a stronger solution is made by adding eleven gallons of water to this stock solution. Whale-oil soap, using one pound of whale-oil soap to five gallons of water, may be used instead of kerosene emulsion. Commercial lime-sulphur used in the proportion of one part in 30 parts of water has also been found useful.

The San José Scale (*Aspidiotus perniciosus*, Comst.). During the past year, this insect has spread slightly; cases were reported from York and Prince Edward counties, Ontario, and a single case from Zephyr, Ontario. The latter case was eradicated and the other cases were due to the transference of infected stock from the infected regions in the province. No further cases of the introduction of this insect have been reported from the other provinces of the Dominion, which attests to the efficacy of the fumigation stations. Although the appearance of this scale is not yet familiar to all fruit growers, the methods of eradica-

tion are too well known to necessitate their repetition. The system of winter spraying with lime-sulphur in its several forms, home-made, commercial and self-boiled, has now become so necessary an operation in the cultural systems of the successful and progressive fruit grower that, with its universal adoption, it is not too much to predict the control of this and other scales. Wherever it has been regularly used each year, the scale has been controlled and far better crops of fruit have been produced. The indifferent fruit growers are the greatest obstacles to the attainment of such conditions of control and we must rely on legislation and neighbourly influence to overcome the greatest of obstacles to all progress—indifference.

The Terrapin Scale (*Eulecanium nigrofasciatum* Perg.) was injurious to ornamental maple trees in the southern part of Ontario. It was destructive at Hamilton, Chatham and Humberstone, Ont., but it is a hopeful sign that large proportions of the scales were parasitized.

THE BROWN-TAIL MOTH (*Euproctis chrysorrhœa* L.).

Nova Scotia is still the only province in which this serious pest is known to have established itself, and, since its discovery in that province in 1907, the Provincial Department of Agriculture have carried on annually a most active campaign in the endeavour to obtain control of this insect. Principal Cumming, Secretary of Agriculture, Nova Scotia; Prof. Smith, of the Agricultural College, Truro, and Mr. Vroom, of the Fruit Division of the Dominion Department of Agriculture, have all worked assiduously to attain this end. In the spring of 1907, when the presence of the insect was discovered, over 6,000 nests were destroyed and in the following year about 4,000 nests were known to have been destroyed; these numbers probably represent more than actual nests of the Brown-tail Moth owing to the bounty system which was in vogue as an emergency expedient and under which mistakes might easily be made. In 1909, a careful inspection resulted in the destruction of over 800 nests and during the present winter a large number have been found up to the time of writing. Notwithstanding the increase of the number of nests, it is satisfactory to find as a result of a personal visit and the evidence of Prof. Smith and others, that no nests could have occurred in the districts west of Digby. The most seriously infested localities lie in the district between Smith's Corner, Digby county, on the west and Middleton and Nietaux, Annapolis county, on the east, a district between 40 and 50 miles in extent. With the exception of Nictaux, the western part of this region, including such localities as Bear River and Deep Brook, is the most seriously infested. This region is being thoroughly worked over by Messrs. Payne and Brown of the Provincial Department of Agriculture, and also by Mr. Vroom. In New Brunswick, where there is still greater danger of invasion by this insect, only a few specimens of males have been found. A considerable number of cocoons of the Emperor Moth (*Samia cecropia* L) have been sent to the Division in the fear that they were nests of the Brown-tail Moth. The Department of Agriculture of New Brunswick commissioned Mr. William McIntosh, an observant entomologist, to traverse the country likely to be infested and also to distribute literature and advice in the schools. Up to the present, no signs of the insect having established itself in that province have been discovered. To prevent the introduction of the insect in the form of winter nests on nursery stock imported from Europe, this stock was carefully inspected at the points of destination by our own officers, Mr. Gibson and Mr. Treherne who acted as special inspector. The following letter was sent to all the Canadian nurserymen on our list and the agricultural papers in the different provinces:—

DIVISION OF ENTOMOLOGY,
CENTRAL EXPERIMENTAL FARM, OTTAWA,
January 5, 1910.

To Nurserymen and others:—

We are again confronted with the possible introduction of the Brown-tail Moth into the Dominion in the shape of the winter nests on nursery stock imported from abroad, especially from certain regions in France where nursery stock has been growing in fields bounded by hedges infested with the Brown-tail Moth.

Last year nurserymen and other importers co-operated with this Division in the work of preventing the introduction of this insect by advising us of the arrival and expected arrival of consignments of nursery stock from abroad. This enabled the Division to inspect the stock and to destroy any of the winter nests that were found. Over a million and a half plants were examined and nearly two hundred nests were found on seedlings and stocks of pear, apple, plum, quince, cherry, rose, spiræa, &c. In view of the fact that each nest may contain from 200 to 300 larvæ of this insect, the great benefit to fruit growers, horticulturists and others resulting from the work of last season can readily be understood. In the eastern States thousands of dollars are being spent annually by the various authorities in their efforts to control and prevent the spread of this insect, which has established itself in those regions since its introduction into Massachusetts on imported stock about the year 1890. It is of the utmost importance that all steps possible shall be taken to prevent its introduction and establishment in those regions of Canada now free from its attack, and its further spreading in those places in Nova Scotia and New Brunswick where it has been introduced accidentally. Its establishment in Canada would be most serious to the nurserymen and fruit growers of this country, and every precaution possible must be taken to avert such a calamity.

Will you kindly inform me, therefore, if you are importing or have already imported nursery stock this season from abroad, and the place from which the stock is being or has been imported.

As nests have been found on stock imported during the present season, I should be pleased if you would send me this information at once in order that your stock may be inspected, if necessary. If the stock has not arrived already, would you please send me notice as to the time of its arrival in order that it may be inspected at the time of unpacking, and thus the least inconvenience will be caused.

It has been found that fumigation is of no avail against this insect, and that destruction by burning of the winter nests is the only safe remedy.

I feel sure that all to whom this letter is addressed will be alive to the seriousness of the danger which is imminent, and will co-operate with the Division and other authorities in the efforts being taken to prevent the introduction and spread of the Brown-tail Moth. I shall be pleased to supply further information or reply to communications on the subject, and shall be grateful for any assistance which you are able to give me.

I have the honour to be, sir,
Your obedient servant,

C. GORDON HEWITT,
Dominion Entomologist.

The Department of Agriculture of Ontario willingly co-operated and gave us the assistance of an inspector. Through the courtesy of the importing nurserymen, every case of nursery stock is being carefully inspected. It is a pleasure to acknowledge the assistance of Dr. L. O. Howard, Entomologist and Chief of the Bureau of

Entomology of the United States Department of Agriculture, who has notified us of a large number of shipments of European nursery stock passing through the United States *en route* for Canada, and also the assistance of Mr. Geo. G. Atwood of the New York State Department of Agriculture, who also sent notifications. These notifications assisted us in making arrangements for the inspection of the stock, and we were also notified of the arrival of nursery stock by the Collector of Customs at the different ports of entry by arrangement with the Department of Customs. In British Columbia the inspection was left in the hands of the Department of Agriculture for that province, and Mr. T. Cunningham, the Provincial Inspector of Fruit Pests, has assured us of the extra care that is being taken in the inspection of European stock.

This inspection is resulting in the finding of several hundreds of the winter nests on imported stock. The results of last season's inspection, which was concluded in May of the present fiscal year, were given in the last annual report; but as the inspection in Nova Scotia, in Ontario and in British Columbia is not yet concluded, the results must necessarily be deferred until the next year's report. The results of this season's inspection so far indicates that a greater number of nests are being discovered on European stock and a larger amount is being examined. Under the new Destructive Insect and Pest Bill* now before Parliament, it will be possible to inspect all European and other nursery stock likely to be infected with the winter nests of the Brown-tail Moth upon its arrival in Canada, and also to inspect orchards and other premises upon which it may occur. The greatest danger is the indifference on the part of the public and the failure to realize the serious importance of this pest which is entailing an annual expenditure of over a million dollars in the New England States. Its presence in the form of the winter nests or webs is easily discovered and its destruction is still more easy. The simplest means of eradication is the cutting off and burning of the winter nests, which may contain from a few dozen to as many as two thousand caterpillars; the usual number being about two or three hundred in a nest of average size. During the five winter months, when the leaves are off the trees, these nests are readily seen and it is during this period that a careful search should be made of orchards likely to be infested, and such adjacent trees as wild thorn and apple. The nests have also been found on oak, maple and elm in Nova Scotia, and the danger of the insect establishing itself in the forests and bush is one of the most serious aspects of the problem, as it affects us at present. In the States of Maine and New Hampshire it is gradually spreading northwards, and in the north-eastern region of Maine has reached already the international boundary, the St. Croix river. It is of the greatest importance, therefore, that a most careful watch should be kept in the townships bordering the frontier and, should anything be found, it should be immediately reported to the Department, and any objects that may be suspected as nests of the Brown-tail Moth should be forwarded for identification. A full account of the life-history and methods of eradication of this insect have already been given in the reports of the Division for 1906 and 1909, and, as a special bulletin is in preparation, it is not intended to consider at further length what is at present the most serious insect pest with which we have to contend.

A SYSTEM OF SPRAYING FOR INSECTS ATTACKING APPLE.

Reference will be made later to the species of insects which have proved injurious to fruit and fruit trees in Canada during the past year but, before considering these, it has been thought advisable to explain how a uniform system of spraying will serve to control a number of these insects which are injurious to the foliage and fruit. Immediately the buds have opened, the half-grown caterpillars af the Eye-spotted

* The Destructive Insect and Pest Act was passed shortly after the end of the fiscal year and the Regulations were ordered in May.

Bud-moth, and, if they are present, the larvæ emerging from the winter nests of the Brown-tail Moth, aud sometimes the hibernated adults of the Plum Curculio, all begin to feed on the young and tender foliage and in a few days they are assisted by the numerous newly-hatched Teut Caterpillars. All these insects could be controlled to a very great extent by *an early spraying* when the leaves are unfolding. The importance of this spraying cannot be too strongly urged. Later, when the blossoms are falling and the young fruit is forming, the Codling Moth caterpillar makes its appearance; a second spraying with an arsenical spray is necessary for this, especially as the largest proportion of the eggs of the Codling Moth are deposited on the foliage upon which the larvæ feed for a short time before making their way to the still open calyx of the young apple. To coutrol this insect, and such others as the Cankerworms and Tent Caterpillars which are beginniug to feed about this time, *a second arsenical spraying* should be given and this application should be most thorough, coveriug the upper and lower sides of the leaves and taking care to fill the calyces of the newly formed fruit with the solution. *A third application* of the spray should be made a fortnight later. This is essential, as, in many instauces, the eggs of the Codling Moth and other caterpillars are late in hatching, or the hatching extends over a considerable period. Also, in certain cases, the Plum Curculio is a pest about this time and injures the young apples. Where a second or partial second, brood of the Codling Moth occurs, it will be necessary to make a fourth application to control the progeny of those insects of the first brood that escaped the effect of the previous sprayings. This application should be made from six to eight weeks after the falling of the blossoms.

Experiments have been carried on in America and in Europe for many years with a view to finding the best arsenical poison to use for these leaf-eating beetles and caterpillars and the results on the whole furnish strong evidence as to the superiority of lead arsenate over other arsenical compounds. This superiority is due to the followiug properties of lead arsenate.

1. It may be applied to tender foliage and does not scorch or burn it.

2. It is in the form of a finely divided precipitate and, in consequence, it is unnecessary to constantly agitate the spray fluid to ensure the even distribution and constant strength of the arsenical.

3. It is more adhesive to the foliage than Paris green, remaining on the trees longer, and, being white in colour, it is possible to see that the trees are thoroughly sprayed. In all these applications it should be mixed with the Bordeaux mixture or lime-sulphur, whichever of these are used to control the fungal diseases and should be mixed in the proportion of two to three pounds of lead arsenate to a barrel (40 imperial gallons) of the Bordeaux mixture. If lime-sulphur is used, it will be found that the best results are obtained by using the self-boiled lime-sulphur and adding the lead arsenate in the same proportion as above. Great care should be taken in the preparation of the Bordeaux mixture or its alternative the lime-sulphur mixture, as the burning of foliage and injury to the young fruit is, in the majority of cases, due to a mistake in making the mixture. The methods for making these insecticides are given in detail in the report of the Dominion Botanist for the present year.

INSECTS INJURIOUS TO FRUIT AND FRUIT TREES.

The Codling Moth (*Carpocapsa pomonella* L.)

This still continues to be one of the most injurious insects with which fruit growers have to contend. It can be controlled, if growers are only willing to take the necessary steps: systematic spraying at the correct times aud from year to year. Much trouble is caused, as I have pointed out previously, by the indifferent persons who do not spray and whose orchards act as reservoirs for this aud other insect pests.

Such indifference can only be overcome by education and example. Where there are two annual broods of the insect, it is necessary to band the trees with burlap, leaving the upper and lower edges of the burlap open. Even when one brood only is normally present, the value of the burlap is probably sufficient to warrant its use. Experiments have shown that if the trees are banded early in August and the burlap examined at weekly intervals, a considerable number of cocoons are obtained which would otherwise have escaped.

The Bud-worm or Eye-spotted Bud Moth (*Tmetocera ocellana* Schiff.).

In Nova Scotia, the injuries due to this insect were of a serious character during the year although it did not appear to be so injurious in Ontario. There appears to be a marked periodicity in its abundance. The difficulty in dealing with the Bud-worm lies in the fact that it not infrequently has committed the most serious damage, that is, the destruction of the young leaves and immature blossom in the opening bud, before its presence is noticed. It is therefore necessary to be prepared, and to take the necessary steps *before* the injury is done by this insect as it is far more serious than a mere leaf-defoliator. It is one of the worst pests of the apple in that it destroys the young leaves and blossoms before these have had a start and is therefore capable of causing the entire destruction of the crop.

The young larva, measuring about one-eighth of an inch in length, passes the winter as a young caterpillar of a brown colour with a black head, sheltered in a small cocoon-like structure which is usually formed in the crotch between two twigs or between the twig and a bud. When the buds are opening, it emerges and begins to feed on the immature leaves and flowers and continues to feed until June or July when it spins a cocoon among the dead leaves on the twig, and the small grayish moth measuring about three-fifths of an inch across its wings emerges in July. It derives its name from the fact that it possesses an eye-like spot on each of the fore-wings. Flying by night, these moths deposit their inconspicuous eggs on the leaves. In about ten days these eggs hatch and the young larva feeds on the lower side of the leaf near the midrib. It feeds sparingly on the soft tissues of the leaf and its growth is extremely slow. For eight or ten weeks it continues to live in this position constructing for itself a filmy silk-like covering as it continues feeding. In September it ceases to feed and seeks a convenient niche in which to spin its winter case, and thus sheltered it remains until the buds open in the following spring. It will be seen, therefore, that there is a single annual brood only and the insect is remarkable for the comparatively great length of time which it spends as a small larva, hardly measuring one-eighth of an inch in length. The early spraying suggested previously is essential for the control of this serious enemy of the apple.

The Apple Maggot (*Rhagoletis (Trypeta) pomonella* Walsh).

In many orchards in Quebec this insect, or as it is sometimes called the 'Railroad worm' on account of the peculiar winding tracks it makes in the pulp of the apple, is one of the most serious insects attacking the apple. The insect belongs to a large family of two-winged flies—the *Trypetidæ,* which are popularly known as the Fruit-flies. They are small flies with banded or mottled wings and may be seen hovering round ripe and rotten fruit. In this country and in the United States *R. pomonella,* the Apple Maggot, is one of the worst apple insects in those districts in which it occurs; in Italy the Olive-fly (*Dacus oleæ* Rossi) is the most serious pest of the olive; the Mediterranean Fruit Fly (*Ceratitis capitata* Wiedemann) is very destructive to oranges in the regions round the Mediterranean. *Rhagoletis cerasi* Linn. is very destructive to cherries in Europe. In Queensland and New Sotuh Wales the Queensland Fruit Fly (*Dacus tryoni* Froggart), has caused great loss wherever it occurs, as it attacks a large number of species of fruits such as the peach, nectar-

ine, orange and banana, and occasionally the possibility of the introduction of this species into British Columbia has been the cause of some alarm.

The chief reason for the serious nature of these fruit flies is that the injury is done by the maggots or larva of the fly *inside* the fruit and in this connection they cannot be reached by insecticides. The female fly usually begins to deposit her eggs in July and continues to do so during the summer months. By means of her sharp ovipositor the egg is inserted beneath the skin of the apple so that the larva, on hatching, immediately begins to feed and as it feeds it makes brownish, discoloured burrows through the pulp until it is full grown, which is in about six weeks. A single apple may contain a number of maggots, the work of which causes the fruit to ripen prematurely and fall to the ground. The full-grown maggot then leaves the fruit and enters the soil to the depth of about two inches and changes into a brown puparium. In this state it passes the winter, emerging as a fly in the following June.

The most sure remedy, therefore, is to gather and destroy by burning the prematurely ripened and fallen fruit *as soon as it falls*. In this manner, the maggots are gathered before they leave the apple and can be destroyed. Wherever this plan has been adopted in orchards affected with the Apple Maggot, it has been found that there has been a considerable diminution in the number of apples affected, but it is necessary to collect the fallen fruit at once in order to obtain the best results. The turning of pigs into the orchard to destroy the fallen fruit has met with success, but many orchardists prefer to keep animals out of the orchard. An important fact is generally overlooked. It is extremely probable that the Apple Maggot (*R. pomonella*) is a native of North America and originally fed on the wild crabs, haws and certain other *Crataegi*, upon which it still feeds. If such trees exist, therefore, in the neighbourhood of orchards infested with Apple Maggot they should be cut down; otherwise they will serve as a breeding ground, furnishing a constant supply of the insects and all attempts to destroy them in the orchard will be frustrated.

Recently, some interesting experiments have been carried on with a view to destroying the female fruit flies before they lay their eggs. Their love for sweet substances is well known, and this fact has been put to practical use by spraying the foliage of the fruit trees in places with a sweetened arsenical, or hanging small supplies of the sweetened arsenical or poisoned bait in various places among the fruit trees. Such methods have been followed with success by Prof. Antonio Berlese in Italy against the Olive Fruit-fly (*D. oleæ*) and by Mr. Mally against the Fruit fly (*Ceratitis capitata*) in South Africa. The latter used a poisoned bait of the following composition: Sugar, 3 lbs., arsenate of lead, 4 ozs, and 5 gallons of water. It was applied to the trees by means of an ordinary brass garden syringe, using about a pint to a pint and a half to each tree (of about 10 years old). The object is not to thoroughly spray the trees but to throw the solution in fairly large drops on to each tree when the flies first appear and before they lay their eggs. They are attracted to the poisoned bait and die as a result of feeding upon it. It should be applied at least every ten days. It is hoped to carry out some experiments in Canada with a view to testing the efficacy of the Mally formula and Prof. Berlese's formula which differs slightly, but the former is described here in case certain fruit growers should wish to test it. The possible injury to bees has been suggested, but in the trials in South Africa careful attention was paid to this question and it was found that honey bees did not pay any attention to the solution. As the different broods of the Apple Maggot extend over the whole of the summer, it frequently happens that the fruit that is gathered contains growing maggots. Such fruit is packed and the maggots, having finished their growth, leave the apples and pupate in the barrels or cases. In this manner, the insect is often distributed to regions not previously infested. Care should be taken, therefore, to carefully collect and burn all the refuse from fruit stored in rooms or barrels before the flies emerge, which may be as early as May when the pupae are kept indoors. It has been found that by keeping the infested fruit for

a number of weeks in cold storage, the maggots are killed by the prolonged low temperature.

The Plum Curculio (*Conotrachelus nenuphar* Herbst).

In addition to being one of the worst pests attacking plums, this weevil is responsible for serious damage to apples. In the province of Quebec, its attentions are chiefly confined to the apple, and in Ontario considerable injury is frequently caused in June and July and also from August to October by the weevils puncturing the fruit and the formation of wounds and small decayed spots caused by the rotting of the apple in the neighbourhood of the puncture. It was reported from Hamilton, Prince Edward Island, as injuring cherries. The emergence in the spring of the adult weevil from its hibernation varies considerably, and may extend from the time the leaves are unfolding until several weeks later. The system of spraying recommended will be of great benefit in the destruction of the weevils as they feed for a short time on the young foliage and fruit before laying their eggs in the fruit. In this manner, the proportion of infested fruit will be greatly reduced. In a number of experiments carried out by Mr. F. L. Washburn, State Entomologist of Minnesota, he obtained 53 per cent of marketable fruit when the trees were not sprayed, and 77 per cent of marketable fruit (in the following year, 1908, he obtained 86·4 per cent) when three applications similar to those which have been suggested were made. As the larvæ are in the apples when they fall to the ground, the destruction of the windfalls, as in the case of the Apple Maggot, will reduce the numbers of the insect very considerably. A method which is very frequently employed for the destruction of the adult weevils is that of jarring the trees and causing the beetles, which feign death and drop when disturbed, to fall into a sheet spread beneath the tree; the beetles so collected are then emptied into a can of water, the top of which is covered with kerosene.

Cankerworms.

Two of these insects, the Spring Cankerworm (*Paleacrita vernata* Peck.), and the Fall Cankerworm (*Anisopteryx pometaria* Harris) have been injurious. The loss caused by the Fall Cankerworm has been very great in certain regions, especially in Nova Scotia, where orchards were completely stripped and were very noticeable on account of their brown appearance. The latter species can be distinguished from the former by the fact that it possesses three pairs of clasping legs on the hinder region of the body, whereas the Spring Cankerworm possesses two pairs only. The female moths are inconspicuous, wingless insects, and emerge from October to May, during the time of the year when the leaves are off the trees. They crawl up the trunk and deposit their eggs in regular masses on the twigs. This habit and the wingless character of the female provide an important means of control. Each tree should be banded about four feet above the ground or below the lower branches with a three or four-inch band of 'Tanglefoot' (a good substitute can be made by dissolving resin by heating, and mixing it with an equal part of boiling castor oil). This is applied before the beginning of October, and in the case of the Fall Cankerworm care must be taken to keep the surface of the tanglefoot fresh by passing a coarse wooden comb round it and also to preserve its continuity around the tree. When the female moths emerge they crawl up the trunk and are prevented from reaching the branches by the tanglefoot bands; unless this is kept fresh, however, it will be bridged over by their dead bodies and its object will not be accomplished. This method of destroying the females and preventing them from laying eggs, which is the most essential means of combatting the insect should be supplemented by spraying with arsenate of lead, using not less than three pounds of the arsenical to 40 imperial gallons of water, (or Bordeaux Mixture, if the combined spray is used).

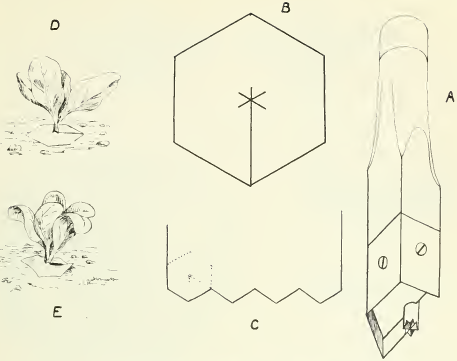


Fig. 1.—Goff's Tarred paper device for the Cabbage Root Maggot.

Fig. 2.—The Cabbage Maggot: 1, maggot; 2, 3, pupa case; 4, fly—1, 3 and 4 enlarged.

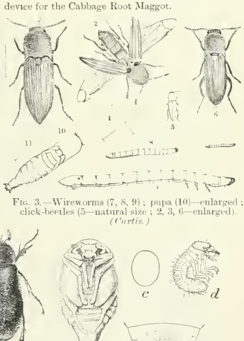


Fig. 3.—Wireworms (7, 8, 9); pupa (10)—enlarged; click-beetles (5—natural size; 2, 3, 6—enlarged). *(Curtis.)*

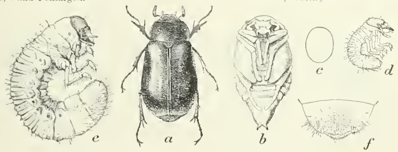


Fig. 4.—May Beetle: *a*, beetle; *b*, pupa; *c*, larva (White Grub)—slightly enlarged. *(Chittenden, Bull. 19, n.s., Div. of Ent., U.S. Dept. of Agr.)*

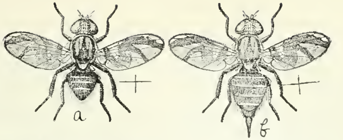


FIG. 5.—Flies of the Apple Maggot: *a*, male; *b*, female—enlarged.

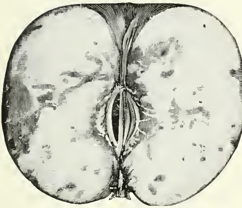


FIG. 6.—Apple infested by Apple Maggot.

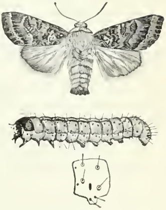


FIG. 7.—The Glassy Cutworm: moth and caterpillar.

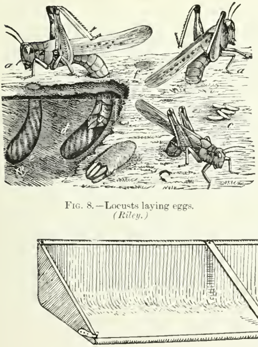


FIG. 8.—Locusts laying eggs. *(Riley.)*

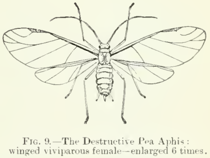


FIG. 9.—The Destructive Pea Aphis: winged viviparous female—enlarged 6 times.

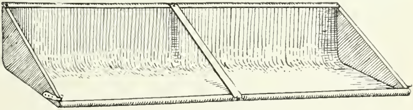


FIG. 10.—A Hopperdozer.

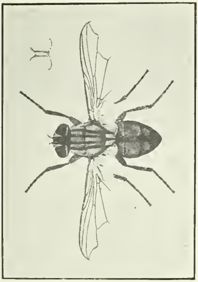


FIG. 11. The House Fly.

FIG. 12.—The Stable Fly.

FIG. 13.—The Lesser House Fly.

FIG. 14.—Maggot of the House Fly.

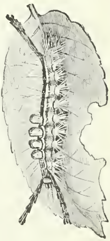


FIG. 15.—Caterpillar of White-marked Tussock Moth.

Other Insect Pests of Fruit.

In addition to the above insects which proved to be the most injurious during the year, outbreaks of certain other species have been reported and investigated, among which the following are worthy of record.

Tent Caterpillars.—Several species, the chief of which are *Malacosma americana* Harris, and the Forest Tent Caterpillar (*M. disstria* Hbn.), have been responsible for great defoliation of orchard and forest trees in the eastern provinces and in British Columbia. The eggs of the two species can be distinguished by the fact that the egg-masses, which in both cases are deposited in the form of a band round one of the smaller twigs, in the case of *M. americana* are rounded at the ends, whereas those of *M. disstria* are cut off somewhat squarely at the ends.

The Tussock Moths.—The White-marked Tussock Moth (*Hemerocampa leucostigan* S. & A.) was reported from Prince Edward Island, Nova Scotia and Ontario. In the latter province, it also defoliated the shade trees in certain of the larger cities. The Rusty Tussock Moth (*Notolophus antiqua* L.) was abundant in Nova Scotia and in Prince Edward Island. Both these insects appear to be subject to parasitic enemies, and their serious injuries are usually of a sporadic nature.

The Red-humped Apple tree Caterpillar (*Schizura concinna* S. & A.) was reported to be abundant in the different provinces of eastern Canada.

The Cherry and Pear Slug (*Eriocampa cerasi* Peck.) was very common in fruit-growing regions throughout the Dominion. Most of the injury appeared to be caused by the second generation, and its results were therefore not so serious as they might have been. The Cherry-leaf Beetle (*Galerucella cavicollis* Lec.) was reported from Nova Scotia in July, and, in one instance, the injuries were so great that the crop was useless. It is a pest of the wild cherry and occasionally attacks cultivated cherries. The Currant Maggot (*Epochra canadensis* Loew) was reported from Lebret, Sask., and the Snowy-tree Cricket (*Œcanthus niveus* Serv.) injured raspberry canes in Ontario.

INSECTS INJURIOUS TO FIELD CROPS AND CEREALS.

Although one of our correspondents writing from Millwood, Man., commented on the variety of new insect pests occurring during the year, which is only to be expected as more land is annually brought under cultivation, there have been no very serious outbreaks of insects injurious to cereals reported to the Division. With the exception of White Grubs and Wireworms, which have already been discussed, the insect most seriously injurious to field crops appears to have been the Hop-flea Beetle (*Psylliodes punctulata* Melsh). In many localities in the provinces of Ontario and Quebec, grasshoppers have been the cause of considerable loss to farmers and it is unfortunate that so few, if any, of them attempt any eradicative measures but allow these insects to increase by accumulation.

The Hessian Fly (*Mayetiola* (*Cecidomyia*) *destructor* Say) was reported from Ontario and also from Saskatchewan, and the Greater Wheat-stem Maggot (*Meromyza americana* Fitch) also occurred in a number of localities in Ontario. At Claresholm, Alta., the Western Wheat-stem Sawfly (*Cephus occidentalis* Riley & Marlatt), was so injurious to wheat that in certain places it was difficult to harvest it, owing to the wheat being laid flat by the breaking of the stems.

The treatment of insects injurious to cereals is by cultural methods devised in accordance with the life-history of the species in question. The most important of these methods are clean farming and the prompt destruction of volunteer crops.

In the case of the Hessian Fly and the Wheat Midge (*Diplosis tritici* Kirby) the screenings and chaff should be burnt.

Locusts.—In certain regions of Ontario and Quebec the Lesser Migratory Locust (*Melanoplus atlanis* Riley) occurred in large numbers, destroying growing oats and turnips: in a number of cases turnips had been sown twice and both crops were destroyed. Mr. Gibson found the species in enormous numbers in the Baskatong region of Quebec. The same species and also the Red-legged Locust (*M. femur-rubrum* DeG.) were injurious in certain sections of Manitoba, where the Criddle mixture has proved a very effective and at the same time a simple remedy. It is made by well mixing 60 lbs. of horse droppings, 1 lb. of Paris green and two lbs. of salt in a barrel. This mixture is then carted to the edge of the field infested with the locusts which are extremely fond of horse droppings and are killed by feeding upon this poisoned bait. When the young locusts or 'hoppers' are common, they can be destroyed in large numbers by the use of a 'hopper-dozer' which consists of a long shallow and narrow tray containing water covered with coal-oil. (See illustration.) This is dragged over the infested ground and the 'hoppers' leap up on its approach and drop into the water and are killed. Attention should also be paid to the cultivation of the land that has been infested. It is found that the eggs are generally deposited on land which has been under crop, especially if it has been left as a summer-fallow. Wherever locusts have been abundant, all stubbles should be ploughed down as soon as possible and, if the summer-fallowing is adopted, it should be started early. The habit of the locusts of depositing their packets of eggs in cultivated land renders their control in this manner in a large measure possible.

The Hop Flea-beetle (*Psylliodes punctulata* Melsh).—In 1908 it was estimated that 80 per cent of the hop crop in British Columbia was destroyed by this insect and the problem, therefore, had assumed a serious character. It is not the same species as the English Hop-beetle which is *P. concinna*. On visiting the district in October, 1909, I was informed by Mr. Hulbert that the beetle had not been so serious during the year as in the previous four years. This decrease may be due to the active control measures that have been employed in the hop yards and also, to some extent, to predaceous and other enemies. The chief difficulties in controlling the insect are the rapid growth of the hops and the continued emergence of the beetle. Owing to the former circumstance, the value of spraying with arsenicals is greatly reduced by the continued production of new foliage upon which the beetles continue to feed, and the prolonged emergence of the insects provides a succession of the pests. The eggs, larvæ and pupæ occur beneath the soil at a depth of three to six inches, according to Mr. H. T. Quayle, who made observations on this insect. The larvæ feed on the roots of the hop and other plants and the adults have been found feeding upon nettle, potato, mangel, beet, turnip, dock, lamb's quarter, pigweed and red and white clover. It is of great importance to keep down wild solanaceous plants and weeds and to adopt such clean methods of cultivation as the burning of all refuse and old vines. Mr. Hulbert, (Chilliwhack, B.C.), found the following measures of value in destroying the adult beetles: smearing the stems of the vines with tanglefoot to a height of about a foot from the ground, shaking the beetles off the vines on to tarred cloths or boards held down below on the ground and also dusting off the beetles with a feather brush on to tarred boards or cloths. Deep ploughing in the fall is also to be recommended.

The Potato Flea-beetle (*Epitrix cucumeris* Harr.) was found causing injuries to the potato crop in Prince Edward Island and in certain sections of Ontario. The use of *poisoned* Bordeaux mixture would control this insect as in the case of the common Potato Beetle (*Leptinotarsa decemlineata* Say).

In Manitoba and the west, the Red Turnip Beetle (*Entomoscelis adonidis* Fab.) was more destructive than usual, especially to garden-grown turnips. Mr. Norman

Criddle reports that he found the beetles at Aweme, Man., feeding first on the wall-flower (*Erysimum parviflorum* Nutt.) and the Worm-seed Mustard (*E. cheiranthoides* L.), later they attacked the turnips. The eggs usually hatch in the spring before the cultivated plants are available and the larvæ accordingly feed upon wild species of plants, usually belonging to the same natural order as the cultivated ones, in this case the Cruciferæ (as also is the case in the Flea-beetles). This indicates the importance of *clean cultivation and the destruction of all weeds,* upon which I have previously insisted. When farmers and fruit growers realize that in many of these insect attacks, the intensity of the attack, and often the presence of the insect, is entirely due to the presence of weeds or of wild trees belonging to the same or allied natural orders as the cultivated plants that are attacked, they will be more unwilling to have weeds growing in and around their fields and wild plums and crab apples around the hop gardens and orchards. Clean cultivation is a factor as necessary in farming and fruit-growing to combat insect pests, as clean houses and sanitary conditions are in the prevention of human diseases.

Blister Beetles.—These insects furnish an interesting example of a useful insect which at times becomes noxious. The larvæ of these beetles are useful, owing to the fact that they feed on the eggs of grasshoppers and other insects. The adult beetles, however, occasionally appear in swarms, and, by feeding on the foliage of cultivated plants, cause serious damage. They are elongate and narrow insects and, of the three species which commonly occur, two were reported as being seriously injurious. The Black Blister Beetle (*Epicauta pennsylvanica* DeG.) caused great destruction to the foliage of potatoes in the neighbourhood of Fort William and Algoma, Ont., and in Quebec. It injured potatoes in Manitoba in July and also attacked Delphinium. The Grey Blister Beetle (*E. cinerea* Först) was reported from Cowansville, Que., as attacking horse beans, potatoes and vines. As the larvæ of these beetles are beneficial, the wholesale destruction of the adult beetles is not to be recommended, but when the beetles appear they should be driven off the crops by a line of boys or men walking through the crop with branches or switches, and it is usually found that when driven thus they do not return.

Cutworms.—From year to year these insects, which are the larvæ or caterpillars of Noctuid moths, are constantly reported as inflicting damage, varying in magnitude, to different field and garden crops. Such common species as the Glassy Cutworm (*Hadena devastatrix* Brace), the Red Backed Cutworm (*Paragrotis ochrogaster* Gn.) and the Variegated Cutworm (*Peridroma saucia* Hub.) are the more destructive and were sent in from different parts of the Dominion. The methods which are used in preventing cutworm injuries are: (1) the placing of small metal cylinders round the plants; (2) surrounding the bases of the plants with poisoned bran, prepared by mixing half a pound of Paris green with fifty pounds of slightly moistened bran, and to each gallon of water used in moistening the bran, half a pound of sugar is added; (3) when the cutworms are attacking a crop they can be destroyed by the use of poisoned bait in the following manner: a small patch of clover is well sprayed with an arsenical poison (1 pound of Paris green to 150 gallons of water, or 6 pounds of lead arsenate to 100 gallons of water), it is then cut and the poisoned vegetation is distributed in small heaps around the infested crop, a small board or shingle being placed on the top of each heap to conserve the moisture.

A large variety of insects attacking field crops, vegetables and roots, in addition to those that have already been mentioned, were reported to the Division. The Pea Aphis (*Nectarophora pisi* Kalt) was destructive in certain parts of Quebec and Ontario from July to September. It was found that the small hymenopterous parasite (*Megorismus fletcheri* Crawford), was responsible for the reduction in the numbers of this aphis; parasites emerged on September 15 from aphids collected on September

2. The most satisfactory method which has been found of controlling this insect is that of brushing the aphids off the plants by means of switches and following this up with a cultivator; by these means the aphids are swept off the plants and their return rendered impossible. A special machine for this purpose has been manufactured. The Pea Weevil (*Bruchus pisorum* L.), which has been increasing in abundance during the past few years, was reported from Quebec and also from Ontario where it is more prevalent in the western counties. Farmers are beginning to realize that this insect can be controlled by the fumigation of the seed peas with carbon bisulphide, and it remains for them and other growers to co-operate and secure the fumigation of all infested peas. In such a manner, the weevil could be eradicated from any locality in which it now occurs and at little expense. In certain of the counties of New Brunswick and Nova Scotia the Carrot Rust-fly (*Psila rosæ* Fab.) was responsible for considerable injury to carrots, especially by the maggots of the later broods infesting the stored roots. When the insect occurs in the stored roots, it can be destroyed by fumigation with carbon bisulphide in air-tight receptacles, using 1 to 2 ounces of this chemical to 100 pounds of roots. Where they are attacking the growing carrots, it is even more difficult to apply remedies than in the case of root maggots. It is sometimes advisable to sow as late as possible and thus escape the egg-laying of the flies.

Aphides attacking turnips, cabbages and potatoes were as abundant as those previously described on trees, and probably for the same reasons.

INSECTS INJURIOUS TO FOREST AND SHADE TREES.

Of all injurious insects, these are the most abundant, but the attention that is paid to them is not in proportion to their abundance or importance. Nevertheless, as our forests become annually more valuable as national assets and the shade trees in our cities and towns increase in importance and value in like manner, it becomes more and more essential to conserve these possessions, the value of which is not always sufficiently realized. The formation of forest reserves and of national parks and the improvement of our cities, all these activities necessitate the devotion of greater care to the control of forest and shade tree insects and to the discovery of means to prevent the annual destruction of millions of trees, which goes on at present.

The Larch Sawfly.—The most serious forest insect at present is the Larch Sawfly (*Nematus erichsonii* Hartig.) which is destroying, and has already caused the death of the greater portion of the larches or tamaracks throughout eastern Canada from Nova Scotia almost to Winnipeg. It is repeating the history of the outbreak in 1882-85, when it destroyed practically all the mature larches through this region and the only means of control for a forest insect occurring on so large a scale are its starvation by the killing of its food plant, which repeated annual defoliation is bringing about, and the increase of its natural parasites, which is indicated by observations that we are now making. Fortunately, as timber, the tamarack is not so valuable in Canada as yet, but the gradual exhaustion of the timber supply will increase the value of this tree which is so well adapted for growing in rough and muskeg country, and its collective value as a forest tree should not be lost sight of. The Sawfly was not found west of the Rocky Mountains where the western species of larch is fairly common. It is interesting to note its marked preference for the European larch. A study of this insect and its insect and fungal parasites of both this continent and in Europe is being made.

The Spruce Bud-worm.—In July, the Hon. W. C. Edwards reported that an insect was causing much damage to spruce and balsam in the Upper Gatineau region about 100 miles north of Ottawa. Mr. Gibson visited the infested region and, on examination, found that the injuries were caused by a lepidop-

terous larva known as the Spruce Bud-worm (*Tortrix fumiferana* Clemens). He reported that thousands of empty chrysalids were found on the trees where the caterpillars had been feeding. The enormous numbers of the brownish-red chrysalids, together with the larval excrement and loose, partly-eaten and discoloured foliage gave the conspicuous reddish appearance to the tops of the trees. Beyond the loss of the foliage of the upper portions of the trees, they were not seriously injured. The foliage for about four or five feet from the tops of the trees was almost wholly destroyed. The moths were seen at the time of the visit on July 29 and also on the Central Experimental Farm. The infestation was of a wide nature, occurring not only in Quebec but in the maritime provinces. It was also reported on July 14 from British Columbia by Mr. J. R. Anderson, for whose reports on different insects from time to time we are greatly indebted, as they are of great value to us. In Victoria, B.C., the moths occurred in enormous numbers and the same abundance was reported by Mr. Hanham, of Duncans, B.C. This species was recorded by Dr. Fletcher in his report as Entomologist for 1885, in which year it was reported from Quebec and from New Brunswick and he believed, as I also believe from evidence recently collected, that the damage to spruce in eastern Canada is not entirely due to this insect. In many instances it is no doubt the work of the Bark-boring Beetle (*Dendroctonus piceaperda* Hopk.). The seriousness of the attacks of the Spruce Bud-worm is due chiefly to the fact that it attacks the buds which, in such a slow-growing tree, affects the growth considerably and repeated attacks will kill the tree. When visiting Vancouver Island in October, I learnt that the infestation was increasing and found that the insect was attacking mainly the Douglas Fir (*Pseudotsuga mucronata* Raf.) Sudw. In some ornamental grounds, it was also found that it had been feeding on larch, silver fir, Norway spruce, deodar and African cedar. Dr. Fletcher also found it attacking spruce trees in Manitoba in 1907.

The eggs are laid on the leaves towards the end of July and the young larvæ are pale green. The winter is passed in the larval stage and, when the larvæ continue to feed in the following year, they construct for themselves shelters by binding together the loose leaves or needles. When full grown, which is about the end of June, they are of a reddish brown colour and they pupate in the loosely made shelters, emerging from the pupæ about the middle of July. It was found in British Columbia that the spread of the moth had been in the direction of the prevailing winds, as the moths are very easily carried by the wind.

Bark Beetles.—Several species of bark beetles were reported as causing serious damage to coniferous trees, and it is evident that the destruction of much of the timber in Canada which is attributed to fire and other causes is in no small part due to the work of bark-boring beetles, many species of which attack the strong and healthy trees and by boring through the growth layer retard and prevent the growth of the tree, which, weakened in vitality, is then liable to the attacks of various other species; when finally killed, the timber is attacked by the timber-boring beetles. Trees weakened by fire are susceptible to the attacks of a large number of species of these beetles which are not infrequently responsible for the final destruction of large areas of fire-swept forest. It is of the greatest importance to recognize the attacks of forest pests in the earliest stages when there is often hope of control. Later, when the infestation has reached some magnitude, such hope must be abandoned as a rule.

The Eastern Spruce Beetle (*Dendroctonus piceaparda* Hopk.).—Portions of spruce trees, killed and dying, were received from Cape Breton, Nova Scotia, and they proved to be seriously infested with this species, which was also reported from Digby county, Nova Scotia, and New Brunswick. Dr. Fletcher recorded this species, under the specific name of *rufipennis*, in his report for 1887, as injurious in the Eastern Townships of Quebec. The small reddish brown to black beetles usually emerge about June and boring into the bark they excavate galleries along the sides of which the

eggs are deposited. On hatching, the larvæ feed on the soft lower layers of the bark and form galleries running from the central egg gallery. The early-hatched larvæ are fully grown about August and they change into pupæ and later into mature beetles which hibernate in the larval burrows until the spring. If the trees are barked during the hibernating season they may be felled later, or they may be felled at once, but felling is the only method to be employed in the control of this insect.

From Almonte, Ont., a bark beetle which appeared to be the Black Turpentine Beetle (*Dendroctonus tenebrans* Oliv.) was reported. In this locality many of the balsam and cedar and some pine and spruce trees were dead and other pines were dying. Beetles were taken from tree roots of 15 to 18 inches in diameter and they were very numerous in the underground portion of the tree. This appears to be somewhat northerly for the distribution of this insect. A species of bark boring beetle injuring pines near Lake Joseph, Muskoka, was reported, but no specimens were received.

The Bronze Birch Borer (*Agrilus anxius* Gory).—A large number of the cut-leaved birches on the grounds of the Central Experimental Farm, Ottawa, and in the neighbourhood, were found to be dying off at the tops, and on examination it was discovered that the death of the branches was due to the larvæ of this most destructive insect. The 'flat-headed' boring larvæ were found boring their way in winding and zig-zag burrows through the sap wood, and in some cases the borings extended to the centre of the branch. Branches and twigs of all thicknesses were attacked. This species is under observation, but the available evidence and that of other investigators, notably Slingerland, indicates that once a tree is attacked there is no possible method of eradicating or controlling the insect and the immediate felling and burning of such trees to prevent the dissemination of the insect is necessary.

The Ribbed Rhagium (*Rhagium lineatum* Oliv.).—Adults of this species were found in their characteristic pupal cells on March 3, together with the white broad-headed larvæ under the bark of spruce trees killed in Nova Scotia by *Dendroctonus piceaperda* Hopk. Packard and Felt record this species as being common on pine, for which reason it is called the Ribbed Pine-borer by the latter. Cavities are formed by its boring underneath the bark, and these are usually found filled with frass. These excavations loosen the bark and cause it to fall away. As mature beetles and larvæ occurred together in March, this species evidently passes the winter in Canada in both these stages.

The Birch Leaf-mining Sawfly (*Phlebatrophia mathesoni* MacGillivray).—This insect, for which the above common name is proposed to distinguish it from the leaf-mining Tineid caterpillars, is of interest scientifically as it is a species that has been present in Nova Scotia for about five years and was not described until about October, 1909, when Dr. MacGillivray described it in the *Canadian Entomologist* of that month (pp. 345 and 346) creating a new genus for it. Its attacks during the year have been very severe in Nova Scotia, the birch leaves appearing brown and withered as if the trees had been killed; in consequence, some alarm was created. The larva is a small worm which bores and mines inside the tissue of the leaf and by destroying all the green living tissue of the leaf produces the brown and dead appearance. About the time the leaves are ready to fall, the larva, according to Prof. H. W. Smith, 'spins a circular nest in the mine it has made,' and in this it passes the winter, and, as is the case with a number of the sawflies, it pupates in the spring, emerging shortly afterwards as a small black sawfly. It is not unlikely that the injuries of this leaf-mining sawfly have been mistaken for those of the Birch Skeletonizer (*Bucculatrix canadensisella* Chambers), which is also common in the provinces of New Brunswick and Nova Scotia and was reported during the year from Kings and Digby counties, N.S. The White-marked Tussock Moth (*Hemerocampa leucostigma* S. &

A.) was again injurious to shade trees in certain of the cities, notably Toronto and Hamilton. This species can be controlled by careful and systematic spraying with lead arsenate in the summer and by the destruction by means of creosote or the removal of the egg masses which are readily found in the winter. The Green-striped Maple Worm (*Anisota rubicunda* Fabr.) was reported from Bryer, Que., where it was defoliating sugar maples. The attack was more extensive during the past year than in 1908, and the injured trees were stated to yield much less sugar than the uninjured. This species also feeds on the soft maple. In the Eastern States it does not often occur in sufficiently large numbers to cause any serious damage, but is more injurious in the western states according to Felt. The Midrib Gall (*Cecidomyia negundinis* Gill.) was very abundant on the Manitoba maple in Manitoba and Saskatchewan. At Alexander, Man., a correspondent reported that a windbreak of about 2,000 young Manitoba maple trees were badly infested with this insect.

INSECTS INJURIOUS IN GARDEN AND GREENHOUSE.

In addition to certain of the insects, to which reference has already been made, a certain number of species injurious to plants in gardens and greenhouses, were received. Species of Thrips were injuring asters (Ontario) and roses (British Columbia). At Indian Head a species of *Aleyrodes* or 'White Fly' was destroying fuschias and these insects were also reported from Ontario and Quebec.

In Toronto, asters were destroyed by Aphides or plant lice which were found on their roots. These aphides appear to be placed in such situations by ants, which cultivate them to obtain their excretions of 'honey dew,' and ants are usually found in association with such root aphides. Where root aphides are found in association with ants, the treatment discovered by Prof. S. A. Forbes to prevent the appearance of the Corn-root Aphis (*Aphis maidi-radicis*, Forbes) may be of use and might be tried. A mixture is made of one gallon of wood alcohol and a pint of oil of lemon. If a few drops of this are placed in the soil near the roots of the plants the ants being repelled by the odour may not take the aphides to such roots as are protected. Diaspine, *Lecanium* and *Eulecanium* scales were sent in to the Division having been found upon greenhouse plants, and in all cases it was found that kerosene emulsion removed them readily.

HOUSEHOLD INSECTS.

THE HOUSE FLY (*Musca domestica* L.) (Fig. 11).—While this is the commonest household insect it is at the same time the most dangerous; not on account of its destruction of household effects, but owing to its habits which make it one of the most serious carriers of the germs of such diseases as typhoid fever, tuberculosis, infantile diarrhœa, &c., wherever flies occur in large numbers. No fly is free from germs, but all carry about the spores of moulds and bacteria and this is due to their habit of frequenting decaying substances and excrementous products for the purpose of depositing their eggs. Each female fly lays from 120-150 eggs at a time and one fly may lay six or more such batches of eggs during a single season. These eggs are deposited on any kind of decaying vegetable matter, such as kitchen refuse, &c., or on excrement. The chief substance in which flies are bred is horse manure, and wherever there are exposed heaps of horse manure flies will be present in very large numbers. From the small sausage-shaped white eggs, the maggot emerges and in a few days, if the weather is warm, it becomes full grown (Fig. 14) and changes into a brown puparium from which the fly emerges. The whole development may be complete in 9 or 10 days, or even less in very hot weather, and these flies which emerge are able to begin to lay in about a fortnight, so that the production of enormous numbers of flies is readily understood.

Owing to their serious and important relation to health, it is of the greatest importance to prevent flies from breeding, and this can be accomplished best by several means. No manure heaps should be left exposed within half a mile of dwelling houses for more than seven days. They should be removed within that time, and if possible the manure should be spread on the ground. This periodic removal applies especially to manure heaps in towns. Garbage tins in which flies frequently breed should be kept constantly covered and emptied at least once a week, and all such waste vegetable matter should be burnt. Great care and attention should be paid to the keeping in order of privies; soil or ashes should always be used, as such places, if not kept perfectly sanitary and all excrement covered, will serve, not only as breeding places, but also as possible sources of infection of disease. Where sanitary conditions and cleanliness prevail house flies will not be abundant, but where unsanitary conditions, exposed manure heaps, open garbage tins and heaps of decaying substances are found, house flies will abound in their myriads. To the farmer, care with regard to this insect is especially important, owing to danger of their infecting milk. In and about cow-sheds, where flies are common, the milk in pails should be screened with muslin as such flies are heavily infected with bacteria.

The Stable Fly (*Stomoxys calcitrans* L.) Fig. 12.—This species is common in Canada, especially in the fall. It normally occurs out of doors or in cowsheds and stables, but sometimes enters houses, and as it is a biting or blood-sucking species, it not infrequently bites man. Its general similarity of appearance to the common house fly is responsible for the idea that house flies bite, which is incorrect, as they are unable, by the structure of their probosces, even so much as to pierce the tenderest skins. It will be found that these so-called biting house flies are almost invariably *Stomoxys calcitrans,* which normally feeds on the blood of cattle. The larvæ or maggots have a similar appearance to the maggot of the house fly, and they breed chiefly in decaying and fermenting vegetable matter and excrement.

The Croton Bug or Cockroach (*Ectobia germanica* L.)—This has been reported from many localities as being a very serious pest in houses. It is light brown in colour and has two dark lines on the thorax; it measures about three-fourths of an inch in length. These insects are more than usually difficult to destroy, as they appear to be gifted with special intelligence and to be able to detect that a substance is poisoned. Houses should be kept clean, and all cracks that it is possible to fill should be filled. It has been found that a mixture of borax and sugar is effective as a poison. The painting of all the crevices and likely haunts with a dilute solution of formalin or formaldehyde (formaldehyde is a liquid that can be obtained from the drug store; to one part of this liquid, which should be 40 per cent solution, 10 parts of water are added to make a dilute solution) may be found effectual in eliminating them from a house. A very dilute solution of corrosive sublimate (which is poison) painted in the same manner may have the same effect. There are a number of roach-killing preparations on the market, some of which have a fatal effect on these insects.

Ants.—These common household pests were reported frequently to the Division, and the small red ant. (*Monomorium pharaonis* Linn.) was, apparently, the worst offender. When they occur in large numbers their destruction is difficult. The first essential is to discover their nests, or the situation of such nests, and, having done so, a small quantity of carbon bisulphide should be injected. This solution (which is highly inflammable) volatilizes and the vapour is highly poisonous to insect life. The same treatment may be adopted in the case of ants occurring in large numbers in the garden; their nests should be found and the carbon bisulphide poured into holes made by means of a small stick. Coal oil or kerosene is also effective when poured into the nests of the ants.

THE CARPET BEETLE (*Anthrenus scrophulariæ* L.)—This insect, sometimes known as the Buffalo Carpet Beetle, has been frequently reported as injuring carpets, large numbers of the larvæ or grubs being found round the edges of carpets; it also destroyed woollen goods and furs. The adult insect is a small stout beetle, (see illustration), measuring about one-eight of an inch long and strikingly coloured, having the wing covers coloured black, yellowish-white and red, the red markings forming a line down the middle of the back from which three branches are given off on each side. The larva or grub measures one-eight of an inch in length and its body is covered with groups of hairs. The beetles are common on flowers about June and not infrequently are carried into houses on flowers. In the house they deposit their eggs on the carpets and similar material, and the small hairy larvæ then feed on the same.

Carpets and materials badly infested with the beetle should be cleaned and afterwards treated with benzine (out of doors). If the attack is not great, they can be destroyed by laying a damp cloth over the infested portion and ironing with a hot iron; the hot steam that is generated is fatal to the grubs. The floors should be scrubbed with boiling water. When the carpets are laid, it has been found that the laying of tarred paper in strips about one or two feet wide beneath the carpet, around its edge, will prevent the beetles to some extent from laying their eggs on such carpets.

MITES AND OTHER PESTS.

A number of small creatures which are not insects, although they are classed very frequently with insects, are responsible for injuries to vegetation of different kinds. A large number of these belong to the Arachnids or Spider family, which are characterized by the possession of four pairs of legs instead of three pairs such as the typical insect possesses. This family includes all the mites, red spiders and ticks. In addition to these, the members of another family, of which the millipede is an example, often attack growing vegetables and other crops; cases of such were reported from Ontario and Nova Scotia.

The following were some of the more important of these pests which were reported to the Division:—

THE PEAR-LEAF BLISTER MITE (*Eriophyes pyri* Nalepa).—This mite, which appears to have been introduced into Canada on nursery stock from Europe, is becoming more serious annually. It was found throughout the Dominion, from Nova Scotia to British Columbia, being very bad in certain localities in the latter province. It will attack, not only the leaves of pear but also the young fruit, and the leaves of the apple. Early in the year, when the leaves are first attacked, they appear to be covered with bright red spots and swellings, which are most numerous near the centre of the leaf. Later these spots turn green, and finally brownish-black as the leaves become older and mature. These small spots or tubercles contain the mites, and are galls formed by the young mites entering the breathing pores or stomata of the leaves and feeding on the leaf tissue. The female measures less than one-hundredth of an inch in length. When they are full grown, they deposit their eggs in the galls, and the young mites, hatching out, leave the gall and seek new stomata, and in this manner form fresh galls. The mites pass the winter under the bud scales, especially those of the terminal buds, where they may be found in small colonies. The mites of this group are difficult to eradicate, and the best means that can be suggested is the thorough spraying of the trees, especially the buds, with lime-sulphur. This should be applied in the fall or as late as possible in the spring, shortly before the buds swell.

The mites belonging to this class, the Eriophyidæ, are common on shade trees, and a number of species of *Eriophyes* were reported as causing injury. A species on ash and elm was stated to have caused the loss of several fine specimens of these trees in Quebec. In Ontario, maples were severely infested by another species.

THE APIARY.

Mr. D. D. Gray, who superintends the apiary, reports to me as follows on the wintering of the bees:—

WINTERING.

Thirty-eight colonies were put into the bee-cellar on November 18, 1909. In preparing them for the winter, air was given at both the top and bottom of the hive, each hive being raised from the bottom board about one inch. The cover was removed and replaced by two or three brown sacks. They wintered very well and no colonies were lost. They were taken out of the cellar and put on the summer stands on March 31.

The average weight of the colonies, when put into the cellar, was 46·27 pounds.

The average weight of the colonies, when put on the summer stands, was 36·65 pounds.

The average loss per colony during winter was 9·62 pounds.

The greatest loss for a single hive during the winter was 12 pounds, and the smallest loss 8 pounds. The colonies weighed from 40 to 57 pounds on entering the cellar, and 30 to 48 pounds when placed on the summer stands.

Two colonies, whose average weight was 48 pounds, were wintered in the same state as when taken off the stands; no attention being paid to ventilation. The average loss during the winter was 12 pounds. The bees did not appear to be contented, keeping down at the bottom of the hive, and many died during the winter. With the construction of a cellar in which the heat and ventilation can be regulated, together with the careful ventilation of the hives, the problem of wintering appears to be solved so far as is possible.

Mr. C. A. Burnside has carried on the practical work in the apiary, and to him and to Mr. Gray, whose careful attention to the wintering bees in the cellar is responsible for the excellent condition in which they were put on the summer stands, all credit is due.

REPORT OF THE DOMINION BOTANIST

(H. T. GÜSSOW.)

OTTAWA, March 31, 1910.

DR. WM. SAUNDERS, C.M.G.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit my report on the work of the Division of Botany from April 1, 1909, to March 31, 1910. The report includes some account of the work carried on before I took up my duties in Canada in July, 1909, which was obtained from the records kept in the Division. In taking charge of the Botanical Division, it was important to equip the laboratories and also to form a library composed of standard books of reference and of periodicals, by which means much time and outside consultation would be saved. Owing to the fact that the work of the Division of Botany was hitherto included in the former Division of Entomology and Botany and to the further fact that my predecessor, the late Dr. James Fletcher, devoted most of his time to entomological studies, the laboratories of the new Division of Botany naturally lacked instruments and apparatus for this new and special work. Much time was spent in selecting and ordering the necessary apparatus and literature, and late in the year sufficient was obtained to equip the rooms available and fit them up for use. I am now able to report that the laboratories of the Division are in good working order and that they are satisfactorily equipped with modern scientific apparatus and recent literature. Unfortunately, the space provided for this purpose which at the same time serves as offices for a large amount of executive work and for the accommodation of the Division's Herbarium is rather limited. In connection with the equipment of the laboratories, I paid a visit to Washington, D.C., to become acquainted with the apparatus most commonly in use in the laboratories of the United States Department of Agriculture and with the sources of their supply. This visit was found very instructive and certainly saved time and expense in obtaining here most of the equipment required. In supplying the laboratories, special attention was paid to the requirements for the work involved in carrying out investigations on diseases of plants due to micro-organisms as bacteria and fungi.

Considering the vast extent of the Dominion and the differences in soil and climate, it is most important to establish a centre for investigation of the diseases of plants which annually cause enormous losses to the growers of fruit and farm crops in Canada. Without the co-operation of the fruit growers and farmers, this work will make slow progress, and I earnestly hope that we may rely on the assistance of all concerned in order to render our work generally useful. I am glad to be able to report that the special attention which has been paid to the question of diseases in plants has already shown some results in the timely discovery of the noxious disease of potatoes known as 'Potato Canker,' which made its first appearance on this side of the Atlantic in Newfoundland. So far I have not been able to discover the disease in Canada, and I will not take up time giving further details here, but would refer all who desire fuller particulars to Bulletin 63 of the Central Experimental Farm, which fully describes this disease.

During the past year I have investigated a considerable number of the diseases affecting the grain, fruit, vegetable and farm crops generally, an account of some of which will be found in this report. I have endeavoured to describe the commonest diseases, like pear and apple scab, potato blight, &c., fully, having recognized how little is really known regarding the nature of the diseases and the remedies for their control by some farmers and fruit growers. The results of personal investigation of these diseases as they occur in Canada, together with careful directions against their spreading, will establish a useful record from year to year and will be found of increasing value as time goes on. We shall be glad to examine these diseases under all conditions, as they may behave very differently in various localities, and their treatment may differ considerably from that suggested for the prevention of the same diseases occurring in neighbouring or in European countries.

In addition to this work, much of my own and my assistant's time was occupied in the determination of the large number of plants sent for identification from all parts of the Dominion. It is my very pleasant duty to record the painstaking work and able help rendered me by my assistant, Mr. Herbert Groh, B.S.A. His untiring and reliable work, gladly and often rendered after office hours, has been very encouraging to me.

Considerable additions have been made to the Herbarium of the Division.

The experimental plots which were in existence at the Farm are being continued; some new land has been set apart for experiments on potato scab and other diseases of farm crops. The yield of the plots, occupied by the more useful plants found in Canada and imported from other countries likely to prove of value here, have been carefully recorded. In future it is the intention to extend the trial of fodder grasses to other parts of the Dominion, as in some localities such plants as have been of little value here may be found of use elsewhere.

During the year I paid several visits to farms in the neighbourhood of Ottawa, in the Niagara district and other places where advice was required concerning the extermination of weeds or the prevention of diseases; I also gave addresses at farmers' meetings and appeared before the Select Standing Committee on Agriculture and Colonization to give evidence. In December last I attended and contributed a paper to the meeting of the American Association for the Advancement of Science held at Boston.

I have the honour to be, sir,

Your obedient servant,

H. T. GÜSSOW,
Dominion Botanist.

GENERAL DIRECTIONS REGARDING THE DISSEMINATION AND CONTROL OF PLANT DISEASES.

The term 'plant diseases' is, generally speaking, applied to injuries to vegetation which are caused by more or less minute parasitic organisms belonging to the lowest orders of the vegetable kingdom, as Fungi and Bacteria. These parasitic organisms are capable of destroying living tissues of plants from which they derive all the food necessary for their development. Owing to the absence of chlorophyll or green colouring matter they are incapable of manufacturing their own food, as is, with the exception of a few, the case in plants that possess chlorophyll. Accordingly, the more severely vegetation is attacked by parasites, the more pronounced is likely to be the injury. To check these injuries, involving often considerable loss, and sometimes destruction of the whole crop, it has been the task of the plant pathologist to acquaint himself with the life histories of the parasitic organisms in order to discover the most practicable means to prevent the spread of these injuries. As regards the cure of diseases, *i.e.*, to restore a diseased plant by means of suitable treatment to its former healthy condition, we may state and we believe that every conscientious worker in plant pathology will agree that it cannot be claimed that suggestions in this direction have proved of the slightest value. Though timely treatment may prevent the further growth of the diseased plant from being attacked, yet in many cases the seat of the injury cannot be reached by our present methods of prevention and the plant generally succumbs. Hence, taking this unfortunate state of affairs into consideration, we must concentrate our efforts to prevent disease germs from attacking plants at all. Our knowledge of the disease-causing organisms has advanced step by step, and the careful study of their life histories has resulted in discovering precautions, which if universally acted upon would considerably reduce the losses from this cause. It must be emphasized that co-operative effort will probably produce these desirable conditions. It is of little use if one man only does all he can to restrict disease on his land, when his neighbour is too negligent to join in this important work. The prevention of plant diseases may be dealt with under five separate divisions, namely:—

(*a*) Practice clean cultivation in field and orchard.

(*b*) Make spraying a uniform practice.

(*c*) Practice judicious rotation of crops.

(*d*) Start with good, sound 'seed.'

(*e*) Watch for the first outbreak of diseases and apply immediately for help. Prompt and timely action may yet save the crop.

CLEAN CULTIVATION IN FIELD AND ORCHARD.

(a) Work on the Farm.

The reappearance year after year of many diseases affecting farm crops is, to a large extent, due to negligence in cleaning fields of rubbish of all kinds after harvest of any kind of crop, especially in collecting diseased parts of plants that may be scattered about. Fungi, which before harvest had the whole crop to revel in, suddenly find themselves restricted to very little available food and thus are forced to preserve their own existence by producing their resting stages or spores on any kind of herbage, dead or living, likely to carry them through the winter. On grainfields, the stubbles are left, and the field is strewn over with loose straws. We may here not only discover the winter stages of rust fungi, of grain mildew, but also many obnoxious in-

sects and weeds. On turnip or potato fields, we find roots that are damaged by the implements used in digging them up, leaves and haulms are scattered all over the field and, where club root or late blight was present, we are sure to discover on examination signs of these diseases everywhere. These few examples may serve to indicate how diseases are carried over from crop to crop. There are many farms where sheep or cattle are turned into the fields after harvest to eat up 'anything that may be left,' or where the rubbish is simply left lying on the ground in the belief that frost and snow will get rid of it and thus clear the field and save the farmer the trouble. These are not satisfactory practices. The spores by which fungi reproduce themselves may pass through the bodies of animals without losing their power of germination, or they may experience long periods of severe frost without being killed. The animals, indeed, may serve as a means of polluting other fields by their droppings containing living disease organisms. The only common-sense way of proceeding is to immediately after harvest destroy all rubbish, leaves, haulms, stubble, &c., by fire. This would kill far more dangerous fungi and insects than could be reached by other means. In all cases ploughing should follow the thorough cleaning up of fields. Not only will such measures be beneficial as regards the destruction of plant pests of all kinds, but it will also destroy many young plants of weeds.

(b) WORK IN ORCHARDS.

What has been said on cleaning fields applies also to land occupied by fruit or vegetables. Do not allow cabbage stalks, pea or bean straw, &c., to lie on the ground, but burn it up. Fruit trees require special attention. Scores of fungi hibernate on leaves that may remain on the trees or that have fallen to the ground; they also produce their resting or winter stages on dead branches still on the trees. 'Plum Pockets' do not drop to the ground but remain a source of infection on the tree. Fire blight, apple and pear scab, and most of our orchard enemies are known to pass the winter on many kinds of rubbish, dead-wood, &c., lying about. Thus, after the fruit harvest, proceed to remove, first of all, any dead twigs and branches, scrape off rough patches on bark, cut out canker spots and do general cleaning up work. All dead limbs should be cut to the fresh wood and the wounds should be painted with coal tar or white lead to protect the surfaces from infection. After pruning the trees, collect all brushwood and burn it on some open place; collect also any decayed fruit and leaves and destroy by fire.

Where conditions do not permit of the destruction of dead fruits and fallen leaves by fire, we recommend that these be collected in heaps and mixed with a quantity of unslaked lime. The heaps should be shovelled over from time to time until the lime has slaked. The action of the lime is to destroy any fungi growing on the vegetation: such fungi, if left undisturbed, would be liable to propagate their respective diseases. About one barrel of lime mixed with two cart loads of rubbish would be a sufficient quantity.

SPRAYING.

After fields and orchards are cleaned in this manner, another important step should be taken. In fields, of course, no spraying need be practised in the fall, but orchard trees and shrubs should be well sprayed to prevent diseases in the coming season. We here suggest a system of spraying which if carried out judiciously, would repay the expense and labour many times over. But before explaining what kinds of sprays are to be used, please bear in mind the following common-sense suggestions. It is not advisable to spray trees in foliage when the sun is shining. Never spray during or immediately after rain before the trees are dry. Never spray when rain is expected. Spray early in the morning or after sunset and no injurious results will occur

The spraying solution best suited for use in fall is the lime-sulphur wash. The following formula is recommended in preparing this fungicide:—

Flowers of sulphur..	15 lbs.
Stone lime..	20 lbs.
Water..	45 Imperial gallons.

Weigh out the quantity of lime, which should be fresh, place in a wooden barrel and pour six gallons of water on it. Then add the sulphur, avoiding any lumps being formed, and slake the lime slowly. Stir occasionally and add more water. The heat which will develop in slaking is sufficient to self-boil the mixture. When the lime is all slaked, cool quickly by adding water up to 45 Imperial gallons.

The greater the pressure with which the solution is forced through the nozzle of the spraying apparatus the finer will be the spray and the more economical its use. Never drench your trees, but apply the spraying solutions thoroughly in the form of fine mist.

In the following spring, the trees must again be sprayed about a week or two before the buds burst. The same spraying solution should be employed. As soon as all the leaves have unfolded, the trees should be sprayed with Bordeaux mixture. This spray is intended to cover all foliage with the fungicide and thus prevent their being attacked by fungi. By adding to this mixture some insect poison like arsenate of lead or Paris green, thus preparing a so-called poisoned Bordeaux mixture, leaves may be protected from many injurious insects also. *(Vide Entomologist's Report.)*

PREPARING BORDEAUX MIXTURE.

Four pounds of sulphate of copper should be powdered and tied up in a muslin bag; this to be immersed in a barrel containing 20 Imperial gallons of water until contents are dissolved. Four pounds of stone lime (fresh) should be broken into small pieces and be slaked with a small quantity of water until a fairly stiffish paste is produced. This paste should be dissolved in a separate barrel in another 20 Imperial gallons of water. To mix these two separate solutions, a barrel holding more than 40 Imperial gallons should be employed. The separate solutions of sulphate of copper and lime should be poured slowly and simultaneously into the barrel, the mixture being well stirred at the same time.

Correctly-made Bordeaux mixture should be of bluish colour, slightly cloudy. To test the mixture, fill a tumbler from the large barrel after stirring the mixture and set it aside to settle. After standing some time, there will be a sediment at the bottom of the tumbler, but the liquid should be as clear as water. When the liquid appears greenish-blue, it is an indication that the lime employed was too old and a little more should be added.

NOTE.—This mixture, which is properly a 2 per cent solution, is commonly known as 4:4:40 solution of Bordeaux mixture. Weaker solutions are often needed and are readily made up by diluting the stronger solution to half or even one-quarter strength as desired.

When using Bordeaux mixture, it must be borne in mind that, preferably, fresh-mixed solutions should be employed which are to be kept stirred during the act of spraying. Employ only such spraying apparatus as produces a very fine spray without clogging the nozzle. The spray, in the form of a mist, should reach every part of the tree.

A weaker solution of three-quarter strength (3:3:40) of Bordeaux mixture should thereafter be applied as soon as the petals of the flowers have fallen and one of half strength (2:2:40) employed about two to three weeks later. By means of these successive sprayings following the cleaning of the orchard, very few fungi will appear, and under normal circumstances the trees in the orchard will remain healthy.

When these suggestions have been carefully carried out, there will be less work necessary in subsequent years in scraping and locally treating diseased branches. We repeat here that success in spraying cannot be expected if the spray is washed off by rain immediately after application. In such a case, spraying has to be repeated. We are aware of the labour and cost such treatment involves, but the cost, it has been shown, will be largely repaid at harvest time. In spraying with Bordeaux mixture the growers must be cautioned. Some plants like peaches, apricots and grape vines are often injured by this solution. Peach trees should never be sprayed with Bordeaux mixture of full strength after the buds have opened, and preferably only a solution of half strength (2:2:40) should be employed.

CROP ROTATION AS A MEANS OF PREVENTING THE REAPPEARANCE OF PLANT DISEASES.

While short rotation has proved beneficial in keeping down weeds, a four course rotation or even a longer interval sometimes becomes necessary on land where a diseased crop has been raised. The destruction of rubbish and any portions of a diseased crop may be regarded as the first step towards the extermination of disease. It is, however, safer not to follow closely with the same kind of crop on land that was infested, otherwise the good results of the cleaning of such fields may be rendered useless. It is not proposed to suggest here any particular system of rotation, but it should always be remembered that a field once infested with the germs of disease is likely to be polluted for a long period.

THE USE OF GOOD SOUND 'SEED.'

The term 'seed' is here intended to include potatoes. There are many diseases of vegetables like bean spot, anthracnose, &c., caused by the use of unsound seed. The use of smutted wheat or oats for seed is an equally bad practice. It has often been shown elsewhere that the very best seeds obtainable are the cheapest in the long run. The same may be said of the use of seed potatoes. Whatever trouble may have been taken to eliminate disease from one's fields and to select new fields, these precautions are of little effect when unsound or infested 'seed' is planted. It is frequently urged that spraying increases the cost and labour; farmers should, therefore, exercise care in buying the best kind of seed so as to lessen the labour of spraying. The farmer often buys the cheapest seed, and may thus contaminate his field with diseases and weeds introduced by these means. Smutted grain, potatoes showing discolorations externally or internally are better excluded from use as seed on the farm. Some seasons, however, it may not be possible to obtain faultless seed of the needed kind. The seed should then, before sowing, be subjected to treatment which will be explained in the following pages dealing with specific diseases against which such measures may be recommended.

WATCH FOR THE FIRST SIGNS OF DISEASE.

We would advise the farmers and fruit-growers of this country to be constantly on the alert for any disease appearing. Diseases very rarely attack the whole crop without preliminary signs and great losses may be averted by timely advice. As soon as any unsound condition of crops becomes noticeable, specimens should be sent without delay to the Division of Botany for examination and report. We will do our utmost to promptly deal with inquiries of this nature, but we expect to be helped in coming to our correspondent's assistance *by their sending us sufficient and carefully packed specimens* so that no time be lost by unnecessary correspondence.

DISEASES AFFECTING GRAIN CROPS.

Of all fungus diseases affecting cultivated plants, those known as 'rust' and 'smut' of grain are economically by far the most important. Although, influenced by atmospheric and other physical conditions, these diseases may one year appear more disastrously than another, we are never in any year quite free from their attacks. The same statement practically applies all the world over wherever grain is grown. Regarding the enormous losses due to these parasitic fungi, one must feel surprised that modern scientific research has not yet resulted in the discovery of an absolute preventative. Happily, so much is known that, providing all suggestions are carefully observed, the losses may be considerably reduced.

RUST IN GRAIN.

Rust in cereals attacks all parts of the plants above ground. Cultivated grasses, varieties of grain and practically all wild grasses are subject to rust disease. This fungus grows best on green, healthy leaves producing the well-known rusty spots, and it soon exhausts the food in the cells of the leaves which turn yellow and become useless to the plant as food-producing organs. In a short time more leaves are attacked, the stem of the plant falls a victim to the disease and, in very bad years, such as 1904, the injury is capable of destroying a large part of the crop. This loss results mainly from the shrivelling of the grain which is very imperfectly developed. When drawing a rusted leaf between one's fingers, they will be covered with a fine orange yellow dust, composed entirely of the spores of the rust fungus. These spores are very minute and thus can easily be carried in the air for long distances. The orange coloured spores reproduce the disease wherever they come into contact with other plants of the same order. Later in the year, towards harvest time, one can observe instead of the orange coloured pustules small spots very similar in appearance, but black in colour. Indeed in winter one can invariably discover this form of the rust fungus on old straw. The blackish pustules, which are simply another form of the fungus, are composed of differently shaped spores, which are protected by a thick membrane and which may pass uninjured through the winter. In the following season these spores resume an active life again, but it is remarkable that this form of spore, although produced in the first instance on the leaves of cereals or other grasses, is not capable of germinating on the leaves of these plants. They change their host plant and germinate readily on leaves of various other plants, where they produce another series of rusty spots. In these spots, which are called 'cluster cups,' a third form of spore is produced which, when ripe and when coming again into contact with leaves of the grasses, produces the original pustules which we commonly term 'rust.'

Several types of rust may be distinguished. The commonest of all is known as 'Black Rust' or Stem Rust (*Puccinia graminis*, Pers.) This malady occurs on leaves of wheat, rye, oats, and, less frequently, barley. The fungus passes from plants of the grass family to the common Barberry (*Berberis vulgaris*, L.), and, after producing spores on this plant returns to the grasses and grain, infecting especially the haulms and leaves.

2. 'Brown Rust' or 'Leaf Rust' (*Puccinia rubigo vera*, De C.) produces dark-brownish winter spores and is found mainly on leaves and sheaths of wheat, rye and barley, but may also occur on oats, wild and cultivated grasses, like Brome and Rye grasses, &c. This rust passes on to species of the borage family (*Anchusa arvensis*, L., *A. officinalis*, L.)

3. Crown Rust (*Puccinia coronata*, Corda.) is most commonly found on oats, but has occasionally been found on wheat. It also occurs on grasses closely allied

to oats. It attacks exclusively the leaves, forming rather bright yellowish rust spots, and continues its life cycle on leaves of buckthorn (*Rhamnus catharticus*, L.).

We may regard these three species as the typical forms of Rust fungi occurring on cereals in Canada. Each species, however, is known to show some biological forms, which for our purpose need not be specially referred to.

SUGGESTIONS REGARDING PREVENTION OF RUST IN CEREALS.

Although our knowledge regarding the development of the parasites causing rust has been much advanced in recent years, when it was proved beyond doubt that these fungi leave during some period of their life the plants on which they originally grew, we have also learned that the propagation of the Rust fungi is not altogether dependent upon this change of host. In the case of Brown rust, for instance, it has been observed that this parasite may live through the winter by serial production of new generations of rust spores and also by means of a vegetative mycelium in the tissues of the leaves of winter grain. This unfortunate state of affairs renders preventive measures exceedingly difficult. The prevention of rust diseases would be comparatively easy, if the fungi had to depend for their livelihood entirely upon the secondary hosts. The destruction of these plants would mean an easy solution of the rust problem, but, as it is, this extermination is only one factor in the prevention of rusts. This means of prevention should not, however, be neglected. A thorough search should be made and such host plants be destroyed as may grow in the neighbourhood of the crops. The direct treatment of rusted plants with chemicals has not thus far proved useful, and such application of remedies over large areas would be attended with much expense. Seed treatment, which is of great value in restricting smut fungi, is of no use whatever as regards rust prevention. It is useful, in the first place, to plough the stubbles of rusted grain immediately after harvest. Grasses, such as the common Couch grass, which serves as a primary host for black rust, should be vigorously exterminated. Further, it is of importance to sow the winter grains as late as possible, while spring grains should be sown as early as possible. According to experience, this practice has resulted in minimizing the severity of rust epidemics. The mechanical or physical condition of the soil does not seem to influence an outbreak of rust; observations have shown that the disease may appear in the same degree on all kinds of soils. On the other hand, it has been repeatedly proved that the chemical condition of the soil plays an important role. The use of nitrogenous manures of any kind should be avoided; their use appears to favour the development of rust fungi, while, on the other hand, phosphates have shown a very favourable rust-preventing influence. While these observations are worthy of record, the most important factor to reduce the enormous losses due to rust diseases is undoubtedly the use of seed grain obtained from crops free from rust. Some varieties of grains are more subject to rust attacks than others, and in some years the virulence of rust varies greatly in different localities. Farmers should endeavour to ascertain when buying seed grain whether it was obtained from crops free from rust. There are indications that lead one to believe that rust resistance is a fixed character and that crops grown from rust-free parent stock are far less liable to be attacked. The question of this selection with the view of producing rust-resistant grain is one which engages many investigators and it is hoped that sooner or later a discovery will be made which at least will minimize the extraordinary losses due to this, our most injurious parasitic organism.

SMUT IN GRAIN.

The many inquiries relating to the smut diseases of grain and the existing difficulties in treating the seeds satisfactorily, and in the shortest time possible, have compelled us to start experiments with the view of combating this trouble by the most

practicable means. The results of our investigation will be published in due course. We shall be glad to answer any inquiries regarding the prevention of smut, although we do not treat of this subject in the present report. Western farmers are specially requested to communicate with us on the prevalence of Loose Smut in their wheat crops. This smut, unfortunately, is gaining more foothold in the west in recent years and great care should be exercised to prevent its increase.

DISEASES OF THE POTATO CROP.

There are three main factors responsible for the appearance and spread of any kind of disease affecting the potato crop, and if these are kept in mind by the grower he will generally succeed in keeping his crop free from disease. Potato diseases may occur:—

Firstly: When unsound seed tubers are planted.

Secondly: When sound tubers have been planted on land on which a diseased crop of potatoes was raised previously.

Thirdly: When spore infection of the growing plant takes place.

Thus it becomes very important to know which diseases, brought about in the first instance by spore infection, will also affect the tubers and also how to prevent the outbreak of such maladies. Farmers who are using their own grown tubers for seed can tell generally whether their crop was diseased or not. Hence, they also know whether to expect sound tubers or unsound tubers. But those who buy potatoes for seed elsewhere should be careful to ascertain whether they originate from sound stock. Potato diseases are chiefly spread by the use of infected seed-tubers, and serious infection may be introduced into land upon which crops formerly grown were free from disease. With very little trouble, this means of introducing potato diseases may be averted.

LATE BLIGHT, IRISH POTATO DISEASE (*PHYTOPHTHORA INFESTANS*, DE BARY).

This disease, which has also received the name of 'Potato Blight' and 'Potato Rot,' is the most serious offender in this respect propagated by unsound tubers. First, it pollutes the soil; secondly, affects the tubers, and lastly the growing plants. The chances of preventing this disease are far greater when sound tubers have been planted than where blighted ones were used.

Appearance and Cause.

Although this disease may be regarded as the most common and widely spread, it is still much confused with others, and few farmers are able to recognize, without doubt, whether the trouble is really due to the Potato Blight. The first signs may appear practically as soon as the plants begin to show above ground. Unfortunately these early signs often escape observation, until later in August the whole field represents unmistakable sings of the blight. At first the leaves show, generally around their edges, brownish irregular spots, which soon become black. These are practically the first suspicious signs. If, on examination of the lower surface of the leaves corresponding to the spots, one can observe (by means of a hand lens) a fine, whitish, mildewy growth, then one can generally conclude that the trouble is due to the common 'late blight.' Should damp weather prevail the spots will rapidly increase in size, the foliage becoming black within a day or two, and the crop may be totally ruined. The leaves, as is well-known, play a very important role in the assimilation of food, and if they are destroyed, few tubers can be formed on the plants. For this reason, the earlier potato blight appears in the field, the more severe will be the loss. On the other hand, should the disease make its appearance later in the season, the tubers that have been already formed are very liable to become infested and are thus rendered unfit for seed or for the table. The potato disease is due to the fungus *Phytophthora*

infestans. The whitish film referred to above, is composed of the filaments of this dangerous parasite. Numerous spores are produced which are very minute, and thus are easily carried by air currents all over the neighbourhood, when, on landing on potato leaves, they will germinate and reproduce the disease. Not only, however, are these spores responsible for the infection of the plants above ground, but they also fall to the ground in large numbers, and working their way through the soil, reach the tuber and cause direct infection in that region.

Prevention.

Infested tubers, when stored, will rot and decay, especially when there is little ventilation through the heap. Although tubers may be but slightly affected, the disease is liable to appear if they are used for seed. On the other hand we have observed that sometimes infested tubers produced healthy crops when planted. While this is the case as in many other potato diseases affecting the tuber, we would not advise the use of unsound tubers under any circumstances. The risk is too great and nothing is known of any practical treatment of the tubers to prevent the reproduction of the disease. The tubers to be used for seed should be selected immediately after harvest and should be stored by themselves in dry, cool cellars, which should be ventilated. Early varieties are far more liable to the disease than later ones. It has also been found that the newer varieties are less liable to the disease than the older ones. It is very fortunate that we have a really satisfactory remedy against potato blight. While it may be a good practice to spray the plants as soon as they appear above ground with Bordeaux mixture—and, by adding to it lead arsenate, to protect them from the ravages of the potato bug—yet it has been found sufficient to spray the crop immediately after the first symptoms of the disease are noticed. A 3 per cent solution of Bordeaux mixture, may be employed for this purpose. Spraying should be repeated at intervals practically till the harvest time of the tubers. When employing poisoned Bordeaux mixture, add to 40 imperial gallons of solution three pounds of lead arsenate and keep the solution constantly agitated when spraying. The late Dr. Fletcher referred to two varieties which have shown themselves very resistant in trials made by the Horticulturist, Mr. W. T. Macoun, at Ottawa, viz., 'Holborn Abundance' and 'State of Maine.' We should be glad to hear if these or any other varieties have proved themselves in general practice resistant to this very serious potato malady. In conclusion we should point out that, as the ground where a diseased crop was raised, is likely to be infested for some years, potatoes should not be grown thereon until about four years after. Neither should tomatoes be grown following immediately after a diseased crop of potatoes, as they are liable to be attacked by the same disease.

EARLY BLIGHT, (*MACROSPORIUM SOLANI*, E. & M.—*ALTERNARIA SOLANI*, SOR.)

The disease known as 'Early Blight' has received this name because it is said to attack more generally early varieties of potatoes. The disease to our knowledge is, however, not strictly confined to these varieties, as it is liable to attack any kind of potatoes, early or late. In some years, especially when the potato beetle or the flea beetle is very prevalent, the disease is likely to cause considerable injury to the potato crop.

Appearance and Cause.

Some observers record that the disease is not easily distinguished from Late Blight. This may be so when it is in an advanced stage or when both diseases are present, as is not infrequent, but the earliest symptoms of the disease are very distinct from Late Blight. The leaves are first attacked, showing a larger or smaller number of brownish spots, with a sharply defined roundish or wavy outline. These spots increase in size as the fungus grows and produce characteristic 'rings,' each

progressive growth resulting in the production of a new 'ring.' In time, several spots may become confluent, but the periodical rings are as a rule clearly perceptible. As long as there are only a few spots on the leaves, the damage to the crop is small, but as their number increases the leaves roll up and die, when, of course, the injury becomes serious. The spots have been noticed on the leaf stalks and also on the young sprouts of potatoes. The fungus covers the diseased parts with a dark, olive-green layer and is easily recognized under a microscope by its peculiar club-shaped, many-divisioned, olive-brown spores. When germinating, several divisions in the spores may send out germinal tubes and these, permeating the leaf tissues, serve to rapidly reproduce the disease.

Prevention.

Wherever careful spraying methods are practised, the disease is very unlikely to appear or to cause injury. We recommend the same treatment as suggested for 'Late Blight.'

POTATO SCAB.

'Scab' is without doubt the commonest of potato diseases and is exclusively confined to the surface of the tuber. The well-known scabby patches render the sale of such potatoes for table purposes difficult. When peeled, however, all signs are removed and the potato is as fit for the table as any other kind. This malady never affects the interior of the tuber and may be looked upon as not of serious economic importance, as it very rarely reduces the quantity of the harvest. Scab is very probably due to some parasitic organism which gains entrance through minute scratches in the surface of the tuber, which may be self-inflicted as the tuber grows in the soil. Whether the organism isolated by Prof. R. Thaxter and named by him *Oospora scabies* is the real and only cause of the very common scab disease or whether the scab is due to physical or mechanical conditions, remains still doubtful. Scab of potatoes is well-known in Europe and externally not distinguishable from the malady occurring in Canada and the United States, yet the fungus *Oospora* has to my knowledge, never been observed as the cause of scab in Europe. It has often been observed that the harvest obtained when scabby seed potatoes were planted was quite free from scab, although the tubers were not treated in any way previous to planting. We also know, however, that sound tubers planted on land on which a crop of scabby tubers was raised, showed scab injury in a marked degree. Yet scab has also appeared when sound tubers were planted on land that has never borne a diseased or indeed any crop of potatoes at all. This seems to indicate that the infective source is present in the soil. Alkaline soils are said to favour the appearance of scab, but no reliable conclusion has as yet been arrived at, as the disease is by no means confined to any particular kind of soil. While we point out that the value of scabby potatoes is by no means impaired for table purposes, we would refrain from using such for seed and would endeavour to procure really sound tubers to plant. In order to take every precautionary measure known at present we would not recommend planting sound tubers on land that is known to have borne a diseased crop previously; and in years when it is not possible to secure tubers free from scab we would immerse the tubers intended for seed, before cutting them up, for 1½—2 hours in a solution made up of one part of corrosive sublimate to 10,000 parts of water. No variety of potato has yet been discovered which is not attacked sooner or later by scab. Some varieties certainly show a more pronounced tendency towards it than others. This, unfortunately, varies in every locality where the same kind may be grown.

WET AND DRY ROT OF STORED POTATOES.

Towards the end of the potato season inquiries dealing with various forms of wet or dry rot of stored potatoes are very numerous. It may be said that potatoes harvested in a perfectly sound condition, that is to say, free from mechanical injuries

caused by the implements used in digging, free from disease and physical injury, and when stored under suitable conditions, practically never rot or decay. Potatoes that are much affected in this way have either had the potato disease (*Phytophthora*) Basal Rot, (*Bacillus solanacearum*) or some other kind of disease affecting the tuber, or the growers have been careless in digging the tubers, thus injuring many of them. All such potatoes are apt to decay in storage and the trouble is liable to spread to sound tubers also. Dark and warm cellars favour the development of all kinds of rots and storage diseases. The cellar should be cold, but free from frost, and should be frequently ventilated. The tubers ought not to be piled up too high but should be stored in rather flat layers. At intervals they should be turned over and any diseased tuber be removed when met with. It is a good plan to separate the required quantity of seed tubers soon after harvest, selecting sound and properly sized ones and to store them separately under the most favourable conditions available, when they will be found at sowing time in excellent condition and well worth the little extra trouble necessary to pick them out.

POTATO CANKER (*SYNCHYTRIUM ENDOBIOTICUM*, PERCIVAL)=*CHRYSOPHLYCTIS ENDOBIOTICA*, SCHILB.)

A full account and description of the discovery in Newfoundland of this potato malady, viewed with greatest anxiety in Europe, was given in Bulletin 63, of the Central Experimental Farm, published during the year. In October, specimens of this disease were received by the Division from Red Island, Placentia Bay, Nowfoundland. On recognizing the presence of this serious disease in so close proximity to the Dominion of Canada and in view of the fact that this disease was unknown till that date on this side of the Atlantic the writer sought and received the permission to investigate the nature of the outbreak of this malady in its latest locality; as it was important to observe the behaviour of the newly-introduced parasite under these new conditions and to ascertain whether the disease was at all likely to gain a foothold under the new conditions. It was also realized that to prevent the introduction of potato canker into the Dominion of Canada, the most severe precautionary measures had to be taken. Not only is the disease very destructive to the potato crop, as will be seen from our observation of the malady in Newfoundland, but also cases have occurred where considerable injury was caused to men and animals who partook of potatoes affected by the disease. From our personal experience with this disease in European countries, we may say that we consider it far more destructive than the common potato disease (*Phytophthora infestans*, De Bary), especially as there are no remedies known for the canker, hence potato growers should exercise great care to prevent their using infected seed tubers. We caution especially those who may import seed potatoes in any quantity from abroad. In Europe the disease has been rampant for about twenty-five years and, although no case has yet been reported from the United States, it is possible for seed tubers from Europe to enter Canada via the States. At any rate the greatest caution is advisable where imported tubers are being used. It is hoped that those who have received the bulletin published both in French and in English will be aware of the earliest symptoms of the malady by which it may be recognized. Fortunately, the disease is very conspicuous even in the earliest stages, and, if it is made a practice to examine every seed tuber before planting, it is readily discovered on these tubers by the peculiar swellings varying from the size of a pin's head to a pea and situated round the 'eye' of the potato. Hence all the eyes should be subjected to careful scrutiny. No potato showing any kind of smooth or clustered abnormal growth should be planted. It must be pointed out that in the recognition of the disease in the seed tuber and in the strict destruction of suspicious ones, lies the whole salvation from the introduction and dissemination of this dangerous parasite. My visit to New-

foundland was made at a very unfavourable time of the year, viz. in November and the satisfactory result was largely due to the kindness of all Newfoundlanders with whom I came into contact and amply compensated me for an unpleasant and stormy voyage. My thanks are especially due to the kindness of the Honourable the Minister of Agriculture and Mines of Newfoundland and his courteous deputy, Mr. Turner, at St. John's, Newfoundland. At Placentia Bay the magistrate, Mr. O'Reilly, very kindly assisted in every way, and his energetic services, often rendered at late hours of the night, enabled me to make a good survey of the infested locality. The disease was known practically to most of the growers, all fishermen, who grew the potatoes for their own use on a small scale. Their experience has been to plant three barrels of tubers and their harvest was often less than one barrel of sound tubers. It was discovered that the disease was imported with seed tubers obtained from Scotland as long as ten years ago. In the meantime, it made unchecked progress and has appeared in many localities of Newfoundland. We used the occasion of our visit to Newfoundland to instruct the growers wherever we met with them, and the press also devoted much attention to the outbreak of the disease in this colony so it is hoped that the disease may be wiped out in the island and have no opportunity of being introduced into Canada. The Newfoundland Department of Agriculture requested us to prepare for their use a pamphlet describing and illustrating the disease. This publication was prepared by the permission of the Honourable Mr. Fisher, Minister of Agriculture, and was much appreciated by the Department in Newfoundland. We have endeavoured to leave nothing undone to prevent the introduction of the disease into this country, but we must point out that it mainly rests with the potato growers of the Dominion whether the disease is introduced. We have every hope to see the importation of potatoes from infected areas much restricted or altogether prohibited, if necessary, under the new Act directed against the introduction and dissemination of insect pests and plant diseases destructive to vegetation; which at the time of writing is under consideration before the House. Up to the date of writing this report, there was no single case of potato canker discovered in Canada and we should be pleased to be able to report this every year.

APPLE SCAB (*FUSICLADIUM DENDRITICUM* [WALLR.] FUCK.=*VENTURIA INÆQUALIS* [CKe.] *ADER.*)—PEAR SCAB (*FUSICLADIUM PIRINUM*, LIB.=*VENTURIA DITRICHA* [FRIES.] *VAR. PYRI ?*)

The injury which is caused by these two fungi in apple and pear orchards is well known, but the damage due to their attacks is very often underestimated. In consequence of repeated inquiries received from our correspondents we give herewith a careful account of the appearance, cause and prevention of this very common fruit pest.

Appearance and Cause.

The injury occurs on the fruits, leaves and young shoots of apple and pear trees. Not necessarily, though, will all three parts be found affected on one and the same tree. The appearance of scabby *fruit* is doubtless universally known. We also know that scabby fruit is inferior in appearance, taste, and keeping qualities. The infection of the fruits may take place at a very early stage of their development; it is by no means a rare occurrence to see apples or pears affected, when but of the size of a large pea. To these very early affections—the fungus killing the tissues and thus preventing a uniform swelling or expansion of the growing fruits—the more or less pronounced malformations of the fruits and the well-known cracks and fissures almost constantly associated with fruit scab injuries are due. As a rule, many of the in-

fected young fruits fall early to the ground, and those remaining on the trees are exposed to the attacks of a large number of wound parasites, causing them to decay, while still on the tree. Especially in wet years, naturally deficient in sunshine, the quantity of fruit is much reduced and the quality considerably impaired. Scabby fruits always weigh less, being much smaller in size than healthy, smooth fruits. The following experience may here be related which would serve to illustrate the actual loss due to the ravages of the scab fungus. Twenty-five carefully selected and perfectly sound apples were taken from the yield of one single tree; they accurately represented the average quality. The same precaution was taken in choosing twenty-five average fruits showing scab injury. The samples were weighed, with the following result:—

	Weight in ounces.
Twenty-five apples free from scab..	38
Twenty-five apples scabbed..	15½

It is evident that the freedom from scab involves far larger returns. The fungus growing on the *leaves* is less conspicuous, producing a somewhat sooty appearance in them. In apple leaves, mainly the upper surface will be found affected, while, in the pear, the lower surface shows the sooty areas. The leaves are rarely killed, though they become in time somewhat dull in colour. However, in considering the fact that a dense fungus covering greatly interferes with the natural functions of the leaves one may realize that such trees must necessarily be retarded in growth. In severe attacks, the leaves fall prematurely and the food supply is largely cut off; the result will be unripe wood, and winter injury may occur very early in especially severe attacks, when the tree is liable to produce a new growth and thus use up too much of its reserve food. Naturally such trees will be much weakened and cannot be expected to produce fruit. Thus the feeble growth of trees in orchards which, for years, have been seriously affected with the scab disease is explained. and a useful lesson is to be learned in seriously attacking this pest.

The *young shoots* may also become affected. The fungus begins its work here in the same manner as on the fruit. First one may notice the characteristic blackening of some tips, followed later by a splitting and peeling off of the bark. The progress of the fungus on the small branches is slow, but eventually the tips are killed and thus future growth is impossible. Severe outbreaks result in producing dead tips all over the trees, and they are only fit to be taken up and destroyed, while timely attention and careful pruning would have prolonged the life of the trees. if not saved them altogether.

Prevention.

The fungus causing scab passes the winter in the following manner: First, on the leaves and fruits that have fallen to the ground, when another form of spores (*Venturia*) is produced; these spores are shed early in the spring and germinate on the young leaves, producing the black soot-like spots already described. The soft tissues of the new leaves offer little resistance to the growth of the fungus, and the spores (*Fusicladium*) are rapidly produced, and these in their turn affect the young fruits as soon as flowering is over. Second, small black patches of the fungus growth may readily be discovered in winter on the tips of branches attacked during the summer, as well as in the fissures and crevices of the bark. From these observations the following conclusions regarding prevention may be drawn:—

1. All leaves and fruits lying on the ground should be dug in deeply immediately after harvest, or be collected and destroyed by fire.

2. The careful removal of any dead wood, subsequently to be destroyed by fire, becomes an important necessity in preventing the hibernation of the fungus.

3. The trees should be sprayed thrice with Bordeaux mixture—

(*a*) As soon as the leaves begin to unfold.
(*b*) As soon as the petals of the flowers have fallen off.
(*c*) A fortnight or three weeks after the second application.

The first application is intended to destroy any fungus that has not been removed in autumn. The second and third spraying is to prevent the fungus spores from starting into active life, by germinating on leaves and fruits.

BRANCH CANKER OF FRUIT TREES (*NECTRIA DITISSIMA*, TUL.)

(See Fig. 1.)

Canker spots, that is, rough, scurfy-looking, often swollen and contorted portions on branches of trees, are due to several causes. At least fruit growers apply the term 'Canker' in a broad manner to any rough-looking wounds, or they may confuse aphid attacks or frost injuries with the true parasitic cankers caused by the fungus above named. Repeated frost injury may certainly produce complications similar in appearance to canker; insects' punctures, especially those due to the woolly aphis,

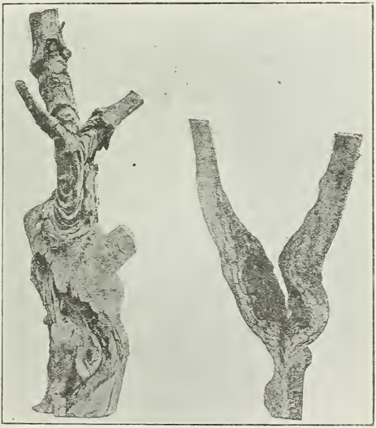


FIG. 1—Branch Canker (*Nectria ditissima*) (after v. Tubeuf).

may irritate the soft cambial tissues and result in the production of small, roundish, gall-like knobs round the edges of wounds, &c., and, finally, cankerous spots may result from an attack of trunk or branch borers. The *Nectria* canker, however, is the

commonest form on our fruit trees, occurring on apple trees far more generally than on pear trees. It is to be met with on all fruit trees, wild or cultivated, and on some shade trees.

Appearance and Cause.

When examining old apple trees, especially in neglected orchards, one is almost sure to encounter some cankerous spots. They may be recognized as rough, deeply-fissured injuries, generally situated at the point of junction where two branches grow closely together, (crotches), or on larger branches around small, dead twigs, which may have been left by careless pruning. In stone fruit trees like plum, peach and cherry, their appearance is less characteristic; in these trees, the bark peels off and curls back and a flow of gum generally acompanies the injury. The best signs by which the true parasitic canker may be distinguished from any similar lesions are the peculiar, more or less regular, concentric rings round the centre of the wound. Less frequent is the so-called covered canker, which is a smoother form with apparently no open wound. These enlarged, gall-like growths, however, will exhibit, when cut open, decaying wood tissues in the centre. In summer, when wet weather prevails, these rough patches frequently exhibit a number of fluffy dots appearing like small tufts of cotton wool. In winter, by using a pocket lens, a careful observer may detect on the rough portion of the wound, often covered by the scaly bark, a number of scattered, deep crimson, globular bodies, less in size than a pin's head. Both stages belong to the same fungus, viz., *Nectria ditissima,* Tul. The former stage produces summer, the latter winter spores, both of which are capable of reproducing the disease, when germinating on favourable spots, such as wounds left from pruning, cracks due to frost, punctures from insects, &c. When any canker fungus spore germinates, it permeates the tissues of the plants with a fine, microscopic spawn and causes the death of the cells in which it grows. As a natural consequence, the dead area becomes sunken and the active, growing layer around the dead tissues endeavours to cover this injury by forming an outgrowth of protective cells around the edges of the wound. These cells are subsequently attacked by the fungus and the renewed attacks and successive endeavours of the plant to heal the wounds caused, finally result in producing the conspicuous canker spots. As soon as the cankerous growth encircles the branch, the flow of sap is cut off and the branch will die.

Prevention.

It has been noticed that not every variety of fruit is liable in the same degree to canker injury. The fruit grower, therefore, should ascertain this in his own case and keep a note of all cankered trees and select such for planting as have shown themselves free from canker spots. The degree of susceptibility of the various varieties of fruits, unfortunately, varies in different localities. This is to say, in the eastern provinces there may be found trees regularly attacked by canker, while in western localities the same varieties may be among those quite free from attacks. Thus it is, at present, impossible to suggest varieties which are universally free from canker and the experience of the observant grower must decide which kinds to grow in his own locality. Information regarding these observations from all fruit-growing centres will be of great value to the Division of Botany and enable it to assist many fruit-growers in different districts.

On the other hand, it has been commonly observed that fruit trees grown on heavy, stiff, clayey soil are generally attacked. Hence it becomes necessary to adopt careful methods of drainage to prevent a general injury from the canker fungus. As a means of preventing canker from spreading, not only the trees in one's plantation should be watched, but also any shade trees or wild fruit trees in the neighbourhood of the orchard, which are also liable to be attacked. The cankerous

branches should be cut out where practicable and be burned. In some cases, however, a chisel may be employed to cut away the diseased tissues, the cutting to extend about one inch all round the cankerous spots and to reach down into the healthy wood. These wounds should then be painted immediately with coal tar or white lead to prevent reinfection. In due course, the production of cells from the active layer underneath the bark of the trees takes place and, providing the wounds have been properly attended to, they will heal over in a few years' time. It is advisable not to operate on the trees during their active process of growth, but to carry such operations out preferably during the autumn.

CORAL SPOT FUNGUS (*NECTRIA CINNABARINA*, TODE).

(See Fig. 2.)

Although injuries caused by this fungus are not confined to fruit trees, but occur on practically all deciduous trees and shrubs, reference to it is made here because of its close relationship to the fungus causing canker of fruit trees. It was not proved until comparatively recently that the fungus is capable of attacking growing, that is living, plant tissues.

Appearance and Cause.

This fungus is far more common and conspicuous than the last species. It occurs on wood of berry bushes, fruit and shade trees, forming prominent

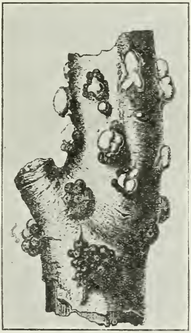


Fig. 2—Coral Spot Fungus (*Nectria cinnabarina*, Tode). In nature the spots which are seen here breaking through the bark are bright red in colour (after v. Tubeuf).

reddish pustules that are spread over the bark of affected plants. These small, coral-coloured spots are soft, cushion-like, summer fruiting layers, of the fungus named above. The fungus spores that are developed in this fruiting layer grow

readily upon tissues which are weakened by some physical or mechanical cause. These pustules are common sights on twigs and branches piled in heaps together, and frequently cover all parts of these limbs with the coral-like spots. Any unprotected (untarred) wound offers opportunities for the germination of the fungus spores. When such has taken place, the fine root-like spawn of the fungus quickly permeates the cells of the growing layer of the trees causing in time the death of the tissues and breaking later on through the pores or accidental cracks in the bark, when the reddish cushions become visible. Thus the fungus is often found appearing all around wounds in the bark of trees. It soon will 'ring' the attacked branch, which in consequence shrivels and dries up all above the seat of the injury. We must here explain that the 'growing layer' or the 'active layer' of trees, (the 'Cambial layer' or 'Cambium' of the botanist) is situated immediately beneath the bark. The most important function of this layer is to produce towards its exterior, bark tissues, while its cells towards the wood form new wood tissues. We may now readily understand, that no growth can take place when the 'growing layer' is destroyed all around the limb of a tree. The sap conducting vessels contained therein are also destroyed and the tops—not being supplied with the necessary materials for their growth—dry up and die. The progress of the fungus is rapid, thus the cambium is afforded no chance to produce new cells. As a result, the wounds do not heal over, as has been described under the note on canker of fruit trees. The spores produced on these red cushions become easily detached and are washed by the rain down the limbs and trunk of the trees, germinating as soon as they land upon the surface of a wound. In spring one can observe occasionally another form of fruiting body very similar in appearance to the winter form of the fruit canker fungus. The Coral Spot fungus rarely produces cankerous tumours like the other canker fungus. The bark remains intact, but is somewhat sunken in, where attacked.

Prevention.

All branches showing the coral-like masses of the fungus should be removed and destroyed by fire as soon as they are discovered. They should not be piled together with any other branches pruned off the trees. Simply removing the attacked branches does not kill the fungus and, if not burned in a short time, the whole pile of twigs and branches will be covered with the red pustules of the fungus and ripe spores will be produced again quickly and sooner or later they are sure to come into contact with some wound. Such a wound may be so minute, that it is hardly perceptible to the naked eye. The mode of life of this fungus indicates the great necessity of attending to wounds as soon as they are noticed. It also emphasizes the necessity of preventing insect pests from establishing themselves in the orchard. It has long been recognized that the small punctures produced by sucking insects and the larger ones due to bark borers, provide places for the germination of the spores of wound parasites such as the Coral Spot disease and numerous others.

SILVER LEAF.

(See Plate 1, Fig. 1.)

The presence of this disease was recognized in apple trees from Nova Scotia. Little is known as yet about the distribution of this malady in other parts of the Dominion, but there is reason to believe that it is more widely present than may appear. It is advisable that growers of any kind of fruit trees should study carefully the following account of the disease and examine their orchards with the view of ascertaining the presence or absence of it amongst their own trees. Specimens of the branches of any tree, that appears suspicious should be immediately forwarded to the Division of Botany for identification. The disease is well-known throughout England and there is no reason to doubt that the malady known as '**Milchglanz**' in Germany is identical with it.

Appearance.

When the disease is present, the leaves of the affected trees, which may be peach, cherry, plum, almond, apple or pear, possess a peculiar silvery appearance or milky white gloss, which is especially noticeable on the upper surafce of the leaves. When bending the affected leaf, keeping the upper surface towards the operator, the epidermis or 'skin' will be observed to be very brittle, cracking in many places, which is not so possible when trying this experiment with a sound, dark green leaf. At the beginning of the disease, a single branch of a tree may show the silvery leaves; they remain of this colour throughout the season and may readily be noticed. In other trees, the whole foliage may appear silvery from the earliest stage. When a branch is attacked, it dies as a rule after one or two years, and another one becomes infected and so on till the whole tree succumbs in time. It is then thrown out and the stump is left frequently in the ground. In autumn, this stump will invariably be found covered with the outgrowth of one of the larger fungi, forming more or less large scaly brackets, marked with a whitish and purplish seam. The fungus will also appear on the dead branches, when the scales are somewhat adpressed and much smaller. In these outgrowing bodies, is produced the fructification of the fungus *Stereum purpureum*, Pers. Numerous small, oval spores are shed when ripe and are liable to infect any unattended wound left from pruning or caused by breakages from wind, snow, etc. The fungus grows in the woody tissues of the affected trees and soon, generally six weeks after an infection has taken place, the leaves will exhibit the silvery gloss. The fungus is closely related to other bracket fungi or punks and like these works its way slowly in the trees, till it has succeeded in breaking through the bark, when the fruiting bodies are produced.

It may be mentioned here that, in the opinion of some European workers, the silvery appearance of the leaves is due to some physiological cause. The disease is by no means fully understood. It is remarkable though, that the fungus *Stereum* is constantly associated with the disease. The writer has observed it in England and has again observed it on silver leaf trees growing in Canada. The fungus is such that it cannot be said whether it is the cause of the malady. At present we regard it as suspicious and we would be glad to have specimens from any locality where the disease may occur to ascertain the real connection of the fungus to this disease.

Prevention.

This will depend greatly upon the extent to which the disease is noticed. If a single branch is affected, cut it right off, to the healthy wood; and keep on cutting away branches till the tree must be taken up as useless. All wounds should be attended to and painted with white lead. Never allow dead branches to remain on the trees otherwise the fungus, should it really prove the cause, will get a chance to produce its fruiting bodies and the disease is liable to spread wholesale. The stumps should be dug up and all infected material be destroyed by fire, as the fungus is capable of producing its fruiting stages on branches, stem and roots, that are left lying on the ground. There is no use in spraying. No spray is likely to reach the seat of the disease, which is in the interior of the trunk and branches.

Our experience with Silver Leaf is that it becomes of considerable importance if no timely measures are taken. Fruit growers attention is particularly called to this occurrence.

FIRE BLIGHT (*BACILLUS AMYLOVORUS* [BURRILL] DE TONI).

(See Plate 2—Fig. 2.)

This disease is also termed Pear Blight and Apple Blight according to which kind of fruit tree is attacked, but it has been proved that, though injuring all kinds

of wild and cultivated apple and pear trees it is caused by one and the same organism. The disease, which is as yet unknown in Europe, is widely spread over the continent of America and is responsible for a considerable amount of damage to orchard trees.

Appearance and Cause.

The disease usually appears very suddenly. The young leaves of orchard trees may just have grown to full size when there will be noticed, without any previous warning symptom, a sudden turning of the uppermost leaves of various twigs to a red-brown colour as if they were scorched by fire. Within a few days the leaves become black and are found hanging in a limp fashion from the twigs, but they do not drop off until late in autumn. Daily, if unchecked, the disease may be seen to spread down the limb and more leaves turn colour. The tips by then have begun to shrivel up, which process follows within a day or two after the discolouration of the leaves. In severe cases, the blossoms and the young fruits that may have developed also turn black. The disease in its progress soon kills off all, even the larger, limbs of the trees, the bark of which often shows large, longitudinal cracks.

The cause of the pear and apple blight is a very minute bacterial organism. It is constantly observed by the investigator in the wood, bark, flowers and fruits of fire-blighted trees, but it is impossible for a casual observer without the help of a powerful microscope and careful study to recognize the organisms. Fruit growers, no doubt, are well acquainted with this disease and can easily distinguish it from other diseases by the symptoms described. The disease has been observed by the writer not only on cultivated and wild apple and pear trees, but on blackthorn, hawthorn, mountain ash and other closely related trees or shrubs. It is probable that stone fruits may also be attacked, but not sufficient evidence has been obtained on this point. It would be of great value if growers were to send any suspicious looking twigs from the latter trees to the Division for examination.

Prevention.

The infection of healthy trees from diseased ones takes place very readily. As this is the case, the longer any diseased twig is allowed to remain on trees the more liable is the disease to spread. It has been shown that the disease germ is carried by bees and other insects from flower to flower and from tree to tree. Speedy removal of diseased branches, therefore, is one of the most important steps in the prevention of the spread of the disease. It is to be regretted that many fruit growers as well as farmers are so indifferent in recognizing this very simple rule in preventing diseases from spreading. The success of the 'Board of Health' of large cities in preventing the spread of any infectious disease like typhoid, tuberculosis, diphtheria and many others can only be achieved if the suggestions concerning the destruction of any contaminated materials or utensils are strictly carried out. Why, then, farmers and fruit growers are so negligent in this direction has never been understood by the writer, for certainly it is unwise to learn a lesson only after experiencing serious losses. There is no use whatever of harbouring in the orchard or on the farm all kinds of refuse and rubbish. Burn it and get rid of it—that is the best advice that can be given, besides being the most important means of checking all kinds of disease. Where Fire Blight is rampant and allowed to make unchecked progress there will be, in time, no harvest. It would pay a grower to employ the services of one man to do nothing else but keep a watch on the trees and cut away at once all signs of the disease and burn them immediately. Not only should wounds resulting from pruning trees, or due to physical or mechanical injury, be painted over with some kind of impermeable paint (such as coal tar, white lead, &c.), but in the case of Fire Blight another precaution is necessary when pruning the orchard in autumn. Where, for instance, a limb is cut off an infested tree, the instrument used becomes infected, and should under no circumstances be used on any healthy tree unless it is wiped

carefully several times with a rag dipped into a solution of Corrosive Sublimate (1 oz. Corros. Sublimate to 1,000 oz. of water). This strong germicide will kill any organism adhering to knife, shears or saw. To simplify matters, it is recommended that the man employed for this purpose be provided with a light wooden box, carried by means of straps like a tray, in which is contained a wide-mouthed glass jar filled with the Sublimate solution and a small tin containing white lead, tar or any other substance that may be applied with a brush to the surface of wounds. Again let it be repeated, burn all wood, that has been cut off, immediately. Always cut right down to healthy wood and leave a smooth wound surface, which is to be painted over.

CROWN OR ROOT GALL OF FRUIT TREES AND SHRUBS.

(See Fig. 3.)

This term is applied to the peculiar knot-like swellings occurring on the 'neck' or 'crown' of all kinds of fruit trees and shrubs. Frequently the same term is used

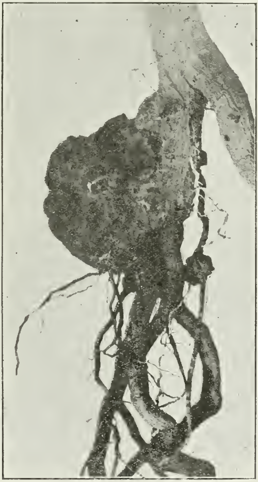


FIG. 3—Crown-gall (original).

in describing similar hard woody knobs occurring on the roots of the same trees. The disease—if, with our present knowledge, we have any right to speak of it as such—is

one universally known to fruit-growers all over the world. By some investigators it is regarded 'as the greatest scourge of fruit culture'; others, however, hold that crown gall is not injurious at all. These two different opinions and frequent inquiries relating to the cause and prevention of this phenomenon caused a very exhaustive inquiry to be made iuto the subject, with the view of ascertaining the prevalence of it in other countries besides Canada and the United States. While those inquiries showed that crown or root gall is known in practically all fruit-growing countries of the world, and also indicated definitely that, if really due to crown gall, the injuries to fruit trees are of little consequence, no information whatever was obtained as regards the cause of it. In reviewing the existing literature on the subject, oue again comes across very contradictory opinions. The majority of publications on the subject agree that the crown gall is a disease, that is, it is due to a parasitic organism; it is contracted and capable of spreading by means of infection. These opinions are held by many scientific men, especially in the United States. The smaller number of observers, without exception experienced growers, not only repudiate the disease theory, but provide ample material worthy of consideration and indicative of little or rather no damage to trees or shrubs on which these swellings are noticed. This state of affairs, in our opinion, is very unfortunate; it plainly illustrates the tendencies of many present-day scientific workers to ignore the most valuable data collected by the experienced practical man. This insatiable quest of the microbe has so frequently made good and reliable men shut their eyes to a clear and common-sense conception of affairs.

We are desirous of learning more of this crown gall, and would gladly welcome any opiniou of our experienced growers as to the damage done to the trees. We ask them cordially for specimens of these galls that they may observe on any kind of fruit tree or berry bush. Information should always be given as to the nature of cultivation, the condition of the soil, and careful records be kept on the appearance of trees that are known to show crown gall, with the view of discovering any external symptom on the growing tree. Only when many hundreds of growers supply these details will it become possible to draw valuable conclusions. Our experience of crown gall at present rather tends to prove that no damage is done to the trees. We have examined large series of seeedlings and trees of all ages and have only discovered hard, woody galls; every case of which we have been able to trace to a former injury to the cambium, such as may be caused, for instance, by a hoe, when cleaning the rows of young trees from weeds. Far less common is the root gall in seedling trees, and, when such were found, we discovered generally a twist or a bend or breakage of tissues. It is a remarkable fact that crown gall and root gall are so common on trees—such as fruit trees—that have been transplanted two or more times; in some cases we have found them to have been transplanted four times. Every transplanting of a tree must cause some injury to the roots however carefully it may be transplanted. The galls which we have examined all showed more or less large developments of so-called callous tissues such as are commonly produced in raising cuttings from woody shrubs or trees. Oue case may be cited as particularly illustrative. In this case, like that of 90 per cent of the trees showing crown galls on the place of union between stock and scion, the gall was observed all around the tissues of the stock; the scion, reaching, with the characteristic tongues practised in grafting, right into the stock, and plainly traceable on both sides, was free from any kind of swelling. It is certainly impossible in this case that any parasitic organism has been involved, or why was not the scion attacked as well? The question of a disease-resisting variety of this scion is too absurd to be taken into consideration. We regard this proliferation of tissues in such cases due to a conglomeration of adventitious buds. There are many examples which may be cited of gall-like protuberances, often as large as a cow's head (*vide,* Bird's-eye formation, 'Maserholz'), in all kinds of trees. Here the buds have formed during the time the stock was growing, but their progress was ar-

FIG. 1.—SILVER LEAF DISEASE IN APPLES *(Stereum purpureum)*.—The top branch shows the silvery appearance of leaves when compared with the healthy twig below. The twigs towards the right show the fructification of the causal fungus.

FIG. 2.—WHITE PINE BLISTER RUST *(Peridermium Strobi)*. 1 Young Pine Seedling showing immediately below branches the pale cushions which in fresh specimens are orange in colour. 2. Winter condition. 3. Currant leaf attacked (after v. Tubeuf).

Fig. 1.—Horsetail (*Equisetum arvense*). A plant poisonous to stock. To the left flowering branch found in spring. To the right, plant as it appears during summer.

Fig. 2. Fire Blight in Apple (*Bacillus amylovorus*).—The two small twigs are killed by the disease; the leaves appear brown in colour. Note the fruit attacked

rested as soon as the scion had 'taken,' the sap formerly largely used in supplying the buds was then conducted into the vessels of the scion and, the pressure being removed, the adventitious buds remained dormant. There are, on the other hand, certain physiological differences in the growth of stock and scion; in some varieties more so than in others. There is the natural difference in the growth of the two kinds of vegetation forced by man's hand to become one. The stock with its roots will always have the advantage over the scion until a perfect union is established. We naturally must expect some deviation from the normal, and the most plausible explanation is the natural functions of stock and scion resulting in the production of a proliferation of growth in the more vigorous of the two. This is our experience in relation to this kind of crown gall. Another kind we have found to arise where a mechanical injury occurred at some time or other to the cambium. Here, like in the root galls, where we also observed primary mechanical injuries, we consider that the formation of wound tissues might alone be responsible for the production of the peculiar knob-like swellings—certainly these tissues may experience all kinds of further physical or mechanical injury and hence still more enlarge—or *parasitic organisms may here step in and do the rest.* But this theory of bacterial injury cannot stand much investigation in considering the behaviour of the tubercular galls of other vegetation; where, when the organism has gained entrance through a wound, galls may be produced at this point, but are known to also appear on other portions of the inoculated plant where no incision was made. This is, of course, owing to the very minute organism being conducted by the sap of the plant to other parts and deposited at some special point where it rests from its wanderings and multiplies and produces other galls. Thus the mode of life of the bacterial organism which is said to be responsible for the production of crown and root galls where mechanical injuries have primarily occurred, certainly differs from any other tubercle-producing organism known. We have never observed any gall formed spontaneously anywhere but on the roots or crown of trees. The evidence of some investigators, we regret, has not been convincing, and while we are quite aware that our own conception is by no means conclusive, we shall be pleased to have any interested investigator examine the many specimens on which our conclusion is based.

In the United States, investigators distinguish 'hard' and 'soft' crown galls; seemingly, only the latter are due to parasitic organisms. We have not seen any 'soft' galls in this country. All specimens that have reached us were hard, woody galls. In connection with these galls, reference is frequently made in the States to 'hairy root.' How closely this hairy root is related to crown gall has not yet been proved. We have no evidence whatever that the hairy root is injurious at all, and are waiting the results of our experiments before expressing any opinion on it. We have, however, come across some interesting observations made by some of our foremost fruit growers, which we wish to cite here, trusting that more cases will be brought to our notice for investigation. One prominent grower had a small area planted with raspberries. These on being taken up showed many 'root galls.' The plants were destroyed and no specimens were sent us for examination. The grower then planted a large area to young peach trees, the rows of which passed through the land formerly occupied by the raspberries on which the root galls were discovered. He then observed that the peaches growing on this latter area were not doing well and finally failed, while all the other trees did exceedingly well. On taking up the failing peach trees, their roots showed plenty of root galls, while the others growing outside the raspberry area were free from it. The same facts were recorded by other growers. There could hardly be given a more typical example of an infectious disease. But, unfortunately, we were not acquainted with any of these observations until it was too late to make any investigation. If these facts as related are correct, and we have no reason to doubt them, there is still a considerable amount of research necessary. We sincerely trust that the fruit-growers of this country will assist the Division of

Botany in reporting immediately any such observations, and thus enable it to make careful investigations; as it is, no means of prevention other than care in planting and hoeing and wrapping the grafts can be offered. It is hoped, however, that the nature of the phenomenon known as root or crown gall may soon be ascertained, and that the confusion at present existing may be cleared up.

BACTERIAL WILT OF CUCUMBERS AND MELONS (*BACILLUS TRACHEIPHILUS*, ERW. SMITH.)

Where this disease has appeared, it worked rapid destruction of the cucumber or melon crop. It differs from many other bacterial diseases in producing no soft rots or decay of any kind.

Appearance and Cause.

The appearance of plants which experience a sudden period of drought is well known to growers by the flagging of the leaves, which symptoms will disappear a few hours after watering of the plants. The bacterial wilt disease of these cucurbitaceous plants somewhat resembles acute drought. But watering has no effect in restoring the plants to their normal conditions, the flagging being rapidly followed by the wilting of the plants. Generally, the disease starts in one or several patches in the field and if affected plants are noticed they should be pulled up, roots and all, and be burned.

On closely examining diseased plants, one is generally able to detect small blanched, elongated patches on the central stems. These parched wounds, undoubtedly due in the first instance to some biting or sucking insect, provide places for the entrance of the bacterial organism which may later be recognized in the vessels of the affected plants. As soon as they become clogged by the bacteria the flow of the sap is arrested and the wilting of the whole vine is the natural consequence. Thus, when receiving specimens of this disease, the recognition of the injury is often found difficult and depends very much upon suitable portions being sent, i.e., the main stem with about a yard of each lateral vine; for no bacteria may be discovered in the wilted portions some distance away from the seat of infection.

Prevention.

Besides preventing insects from attacking melons or cucumbers by the use of insecticides, no remedy can be suggested for the treatment of infected plants. We suggest the immediate removal of any wilting plant and the subsequent spraying of the remainder as soon as possible with poisoned Bordeaux mixture. This measure is entirely directed against further insect injuries and is of no use as a treatment for the wilt itself. Where speedy action is taken, the disease may be much restricted.

POWDERY MILDEW OF GRAPES (*UNCINULA NECATOR*, [SCHW.] BURRILL)—(THE *OIDUM TUCKERI*, BERK. OF EUROPE.)

This malady was first observed in the United States, but it is also common in Canada. In about 1845 it appeared in England and a little later in France and other European countries.

Appearance and Cause.

The powdery mildew appears in form of white flour-like patches on both sides of the leaves. The young shoots and flowers and fruits are equally liable to be attacked as soon as they begin to form. When any of the mildewed portions are rubbed between finger and thumb, a very peculiar musty odour will be noticed. The attacked

parts soon become brownish under the mildewy covering, and the leaves shrivel and die. In severe attacks, no fruit is produced. Moist weather favours the development of the fungus to which Powdery Mildew is due. Under the microscope, the powdery patches are recognized as being formed by the dense grayish-white masses of the fungus, the so-called oidial stage; later on there appear in the whitish patches numerous minute, globular conceptacles in which another form of spores (*Uncinula*) are produced.

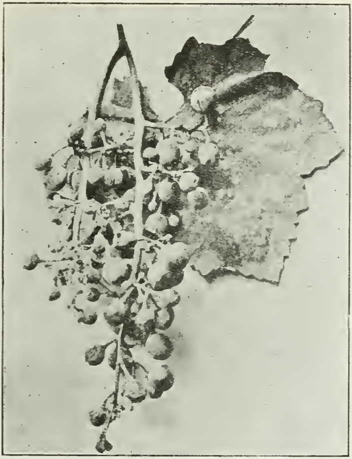


FIG. 4—Powdery mildew on grapes *(Uncinula necator)*. The berries shrivel and burst open. (From Bulletin 38, vol. III, Purdue University).

Prevention.

It is advisable, where the disease has occurred, to prune the vines in the ordinary way in fall, as soon as the wood has sufficiently ripened. Prepare the following paste and apply with a stiffish brush to the vines, taking care to well 'paint' the whole of them. The soil should be removed round the base of the plants and the following wash should be applied as far down as possible. Add slowly under constant stirring enough water to three pounds of common stone lime, that a very thin paste is formed. Then add to this, eight ounces of flowers of sulphur, stir and mix well and apply to the vines. In the early spring, a 2 per cent solution of Bordeaux mixture

should be applied as soon as the first three leaves have been developed. Do not spray vines during sunny weather but preferably on cloudy days. Should any mildew become noticeable thereafter, moisten all parts with a fine water vapour and dust well with flowers of sulphur, covering carefully all parts of the plants. Make it a practice to burn all leaves and wood that are cut off from the old vines.

DOWNY MILDEW OF GRAPES (*Plasmopara viticola*, Berk. *et* Curt.)

This form of mildew attacks practically all kinds of wild and cultivated vines. It may attack any part of the vines, but is more generally confined to the leaves. They are covered by a similar powdery substance to that described in the former disease, but it may be readily distinguished by the peculiar crinkling or blistering of the leaves where attacked. The fungus is not related to the former; it generally appears during the early summer and continues its destructive work until very late in the season. The whitish powder of this mildew is generally noticeable on the

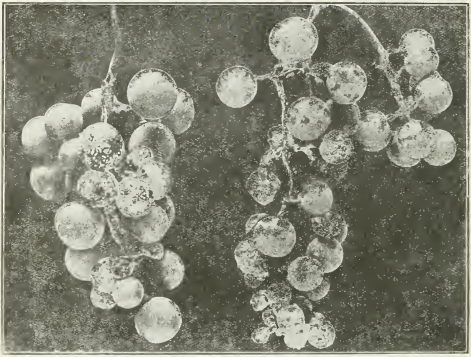


FIG. 5—Downy mildew on grapes (*Plasmopara viticola*). The berries are covered by the mildew. (Frontispiece Fungous Diseases Dugger).

lower surface of the leaves. In the early stages, one may observe on the upper surface yellowish to brownish discoloured spots, and soon the mildew becomes recognizable on the lower surface, corresponding to the spots on the upper. The patches rapidly increase in size and soon cover the whole leaf which becomes brittle and is finally killed. This mildew is very conspicuous on the berries, covering them over with a dense layer of filaments. While in the former mildew, the winter stage is produced on both surfaces of the leaves, here thick-walled resting spores are formed in the tissues of diseased leaves and shoots. The immediate destruction of any infected material is thus a very important factor in preventing the spread of this parasite of vines.

Prevention.

Besides destroying all infected material, periodical sprayings with Bordeaux mixture have proved very effective in checking this disease. Spray in the fall with a 4 per cent solution and begin spraying with a 2 per cent solution as early as possible in spring, continuing to spray the vines periodically with an interval of from five to six weeks, about six or seven times.

The following mildews are common on the specified plants and, as their appearance and treatment is similar, they may here be referred to in a more general way:—

Rose Mildew (*Sphærotheca pannosa* [Wallr.], Lev.).
Peach Mildew (*Sphærotheca pannosa* [Wallr.], Lev.).
American Gooseberry Mildew (*Microsphæra Grossulariæ* [Wallr.], Lev.).
Strawberry Mildew (*Sphærotheca Humuli* [De C.], Burr.).
Mildew of Apple, Plum and Cherry (*Podosphæra Oxyacanthæ*, De Bary).

Also attacking hops, melon, cucumber, and a number of wild plants.

The different fungi named above, and a few additional ones that occur more commonly on cereals, grasses and wild plants (*Erysiphe graminis*, &c.), cause the most common mildew diseases in a large number of plants. They are nearly all included in one group of parasitic fungi known as the *Perisporiaceæ*. The injury is due, in almost all cases, to the conidial stages of the fungi appearing as the whitish covering that is so conspicuous on the leaves of attacked plants. Flowers of sulphur has so far been found the most beneficial specific to apply in order to check most of the mildew diseases. Indeed, if carefully applied, that is, dusted on both sides of the leaves of trees or shrubs by means of a powderizer, following a wetting of the plants, the cure is almost certain in such cases as the rose mildew, peach mildew, &c. We are of the opinion, however, that the lime-sulphur wash should be mainly employed, as soon as any kind of mildew is prevalent. Generally three applications will be found sufficient to check the progress of the mildews. In orchards kept scrupulously clean and well sprayed, mildew diseases have very little chance of existing and causing much damage.

INJURIES TO VEGETATION DUE TO ATMOSPHERIC AND OTHER PHYSICAL CAUSES.

(Heat, Frost, Hail, Etc.: Injuries.)

The Division of Botany frequently receives specimens of various kinds of vegetation which appear to be injured, but in which parasitic agents are entirely absent. These injuries are generally due to mechanical or physical causes, as is proved by microscopical examination of the specimens. We may here distinguish injuries readily recognizable, such as breakages in the trunk of trees through stormy weather or sleet storms, frost cracks, and many others. Besides there are such injuries as only become prominent as the plant grows, i.e., frost injury to dormant buds, scalding of leaves and bark by sun, hail injury, &c. These injuries may more or less affect the life of trees and other plants, owing to the fact that very little if anything can be suggested to prevent them. We must bear in mind that many fungi, otherwise harmless, may seriously attack plant life where any wound surface, left unattended, offers them suitable places for their development. Thus after severe storms, during which branches of trees were broken off, the owner should immediately remove them with a sharp knife and attend to the wounds by coating them with tar or paint. While this may be useful in cases where injuries to large limbs have occurred, no such means prove of success in treating wounds that may be due to hail or sun-scald. These wounds are often very minute and imperceptible, but they are large enough for the spores of many fungi to enter and cause serious injury. The careful fruit-grower who has

experienced any of the possible results from hail injury would resort to spraying his orchard immediately after a severe hail fall. The wounds would thus be covered over with a fine film of the spraying solution used and fungus spores would be prevented from germinating on them. The wounds, thus protected would be unaffected, and would be afforded an opportunity of healing. The process of healing over begins almost immediately after an injury is done. Microscopically, one is able to trace the first signs of this process after two or three days. Though this is the case, one must remember that some fungus spores germinate after a few hours, and hence care should be taken to act in advance of the fungi. Frost has been known to do great damage to fruit trees, but it has been recorded that less injury was done to trees which had been sprayed with slaked lime or lime and sulphur wash. The lime being a bad conductor of heat or cold undoubtedly acts as a protection to the plant tissues underneath. The term 'winter killing' is applied to various injuries due to frost. One of the most important is the so-called 'black heart' or 'black core,' which cannot for some time be noticed externally. We have often traced this peculiar blackening of the centre of branches to wounds from which it spreads a few inches in both directions up and down the branches every year. Subsequently, the branches produce smaller leaves, bear no flowers, and finally die. When, in pruning the orchard, black-hearted branches are observed, it is recommended to cut these right back to the healthy wood and always close the cut with some kind of protective dressing.

In some countries, fruit-growers have resorted with much success to the lighting of a number of fires in their orchards to prevent any possible effects from the late spring frosts, when much damage would result to the opening buds or flowers. These fires are supplied with damp straw or leaves to produce huge volumes of smoke, which, on account of the steadiness of the atmosphere generally preceding cold, frosty nights, spreads slowly and closely over the ground and envelopes the orchard in dense smoke. The fires are kept up during the night, and serious damage has been averted as judged by comparison with orchards where no smoking was practised. After a little experimenting, the grower will soon discover how many fires will be needed to protect his plantation. It is generally not necessary to smoke the whole orchard at once, but select those portions planted with trees which are just starting to blossom.

WHITE PINE BLISTER RUST (*Peridermium Strobi*, Klebahn).—RUST OF GOOSEBERRIES AND CURRANTS (*Cronartium ribicolum*, Dietr.).

The Division of Botany received in August, 1909, the following intimation, by the courtesy of Dr. Haven Metcalf, of the United States Department of Forest Pathology:—

> According to advices received from the American Consul-General at Hamburg, Germany, a shipment of 250,000 white pine seedlings was made by J. Heins Söhne, of Halstenbeck, to the Ontario Agricultural College, Guelph, Ontario, in 1907. As this is the firm which shipped all the trees in America which are known at present to be diseased with *Peridermium Strobi*, this shipment to Ontario should be very thoroughly and carefully investigated, and any disease found eradicated.

It is remarkable that in the original home of the White Pine (Northern America) the so-called White Pine Rust is so far unknown. This rust has worked great havoc amongst young pine plantations in Europe and it occurs also on older trees. Not only is the life of the White Pine endangered, but, as is regularly the case with rust fungi, the fungus causing white pine rust passes through another form of its life history on leaves of cultivated and wild species of gooseberries and currants and is capable of inflicting serious losses in these fruits. In order that the rust may readily be recognized and its eradication proceeded with we give here a careful account of the disease and recommend every one to be on the lookout for it.

When pine trees are affected by the disease, the stems of the young trees or the branches of older ones will show a number of prominent orange-yellowish pustules, between which masses of white resin are seen oozing out from underneath the bark. Unfortunately the spores which cause these orange cushions are not always present on the stems, although the plant may be affected. With a little more careful observation, one may discover a more or less longish swelling or blister, generally covered with resin. When either the orange spore pustules or the swellings of the stem branches are found, it would be advisable to send specimens immediately to us for examination and report. As it was pointed out, the fungus passes through another stage on gooseberries or currant bushes that may be in close proximity to attacked White Pines. The spores originating on the White Pines produce similar orange-yellow spots, like the rust of wheat, on the leaves of currant and gooseberry bushes. The foliage, if badly attacked, easily falls to the ground and the fruit is arrested in its development or ripens prematurely, being in either case much inferior in quality. Towards the end of summer, a new form of spore is produced on these leaves by which the fungus returns to the pines to start upon a new life cycle.

It will be seen that the introduction of this rust would seriously compromise the white pine industry of the country and also be of considerable consequence to the grower of these berry bushes, and it is hoped that all persons concerned will be on the watch and quickly report any suspected outbreak.

On communicating with the Agricultural College of Guelph we ascertained that all possible precautions were being taken. The young pines have been planted in nursery lines at the Guelph College Forestry Station in Norfolk county and are carefully watched. The authorities of Guelph have, in view of the considerable quantity of white pines which they have imported during 1908 and 1907, and which are kept under 'quarantine,' eradicated all species of Ribes within a considerable distance of this field and in fact have destroyed currants and gooseberries throughout this locality. The forestry expert at Guelph has also informed us that amongst the trees for distribution this year there are not included any white pines. We may thus hope that the White Pine Rust will be prevented from establishing itself in Canada.

WEEDS.

While the Division is ready at all times to assist collectors of plants in naming their specimens, yet its primary aim in offering to name plants is to be of use to farmers in identifying the weeds which are troubling them and to advise them in the matter of weed eradication and control. It is an encouraging indication of their interest in weed problems that so many of them have availed themselves of the service offered.

It is very desirable that correspondents, when sending weeds for identification, should give some idea as to their abundance. We call attention to this for the express purpose of urging that more care be taken in future to state fully the facts of the case along with each inquiry. We can never give as useful a reply to a letter which contains no particulars as to one which tells us something about the crop which is infested, the nature of the soil, the system of farming followed, &c. If we knew, for instance, that a certain weed sent was giving trouble in pasture land which could not be brought under cultivation, our advice might be very different from that which we would give for fields under regular crops. Specimens should accompany all inquiries so that we may be certain what we are dealing with.

The majority of the weeds received during the year are such as occur in similar abundance at any time, in the localities from which they have been sent, and there is nothing exceptional about their occurrence to call for special notice here. There are several, however, to which, for one reason or another, some reference should be made.

WEEDS RECENTLY INTRODUCED OR ATTRACTING ATTENTION.

Field Pepper-grass (*Lepidium campestre,* [L.] R. Br.) and Rocket (*Eruca sativa* Lam.) are two weeds which are being reported with increasing frequency each year, the former being introduced mainly in clover seed, and the latter, at least in every case concerning which we have received particulars, in lucerne seed. Both plants are native to Europe, and bid fair to become established weeds with us. Field Pepper-grass is a coarse biennial, with numerous stems densely covered with somewhat stem-clasping arrow-shaped leaves. Unlike the common Pepper-grass, the whole plant is downy with short white hairs. Its pods are also larger, and curiously spoon-shaped. The other weed, Rocket, was first reported in Canada in 1907. Roughly speaking it resembles Wild Mustard, but it is readily distinguished by its deeply-cut leaves, with large terminal lobes, its purple-veined, light yellow flowers, and its short, broad-beaked pods. Where these weeds are found to have been introduced in a seeding, it will be safest to go over the infested fields and pull all that are found. Early cutting of the hay will also help to prevent the maturing of the seeds, but the mowing will have to be repeated later to destroy the new shoots which are immediately produced by both weeds.

In Quebec and the Maritime Provinces, several species of Hawkweeds, (*Hieracium*) notably the Orange Hawkweed or Paint Brush and the Mouse-ear Hawkweed, are giving farmers much trouble. They are most commonly reported from pastures, and when such land can be broken up and worked under a short rotation of crops, it is possible to control these weeds, otherwise they are very difficult to deal with, if they have once spread over any great area. In Ontario, most concern has been shown over the rapid spread of Perennial Sow Thistle. In view of the persistence of its creeping rootstocks, and the facility with which it spreads its seeds, its control is without question a serious problem. Spring cultivation followed by a smothering crop, and a cleaning crop the next year, is perhaps the most satisfactory method of eradication to employ, or a complete summer-fallow may often be advisable.

COMMON HORSETAIL (*Equisetum arvense,* L.) AS A STOCK POISONING PLANT.

(Plate 2, Fig. 1.)

In December, 1909 a bale of hay was received at the Experimental Farm from Beauce county, Quebec, with the complaint that cattle feeding on it had shown symptoms of poisoning. An examination of this hay proved it to be of exceptionally inferior quality, and evidently obtained from a wild undrained meadow. Its bulk was composed largely of a sedge (one of the varieties of *Carex stellulata*); there were also present in smaller quantities, about a dozen agricultural and wild grasses and clovers, several other sedges and rushes and at least three dozen weeds and wild plants, useless for hay. By carefully examining the herbage, my assistant, Mr. Groh, discovered in the inflorescences of *Carex stellulata,* the presence of Ergot grains. This is of double interest, partly because Ergot was hitherto unknown to occur in the genus *Carex* and partly because of its known poisonous properties. By actual analysis of ten pounds of the hay, the proportion of weedy to useful plants (including the sedges among the latter) was found to be about one in eight. The presence of so large a proportion of weeds was in itself sufficiently objectionable; but the main danger in feeding the hay, doubtlessly had arisen from a large amount of Horsetail contained, a weed which has been quite conclusively proven to have poisonous properties. From Europe and the United States, feeding experiments are reported in which horses, fed on hay containing one-quarter its bulk of Horsetail, developed characteristic symptoms of poisoning and ultimately died. No doubt was left as to the responsibility of the Horsetail as the cause of the trouble. The opinion is expressed by American experimenters that other animals are less readily affected, and cattle in particular

are not so likely to suffer. The results of European investigations, however, show that they may also be poisoned. Although no opportunity has been had in this case, to investigate closely, yet the Horsetail present in this hay may be safely held responsible for the injurious effects reported.

Horsetail is a common weed everywhere, growing by preference in sandy soil which remains moist by reason of a shallow water table. Railway embankments through swampy land, are almost invariably covered with it, but fields and pastures may also have it in quantity. Its appearance in one or the other of its stages, is familiar to most people, but many are not aware that these different forms belong to the one plant. The first stems to appear in the spring are thick, pale and unbranched; and have loosely-fitting toothed sheaths at intervals, and cone-like tips which are the so-called fruiting organs containing the spores. A little later, other stems are sent up from the same creeping rootstocks, being bushy with slender, whorled branches and green throughout. These branches are merely vegetative, while the first, producing the spores, serve to disseminate the plant. It also spreads by means of its rootstocks.

The presence of horsetail in fields in the majority of cases indicates a need for drainage, and this defect being remedied, there is not usually much difficulty in overcoming it with cultivation. In pastures, where cultivation is out of the question, there is little that can be done except good drainage; but apparently less is to be feared from its presence there than where it gets into hay, as its virulence seems to be increased by drying. If stock must be pastured where there is any of the weed, a close watch should be maintained for any symptoms of trouble. Among the symptoms of poisoned animals, the first noticeable is unthriftiness; and in from two to five weeks the animal begins to lose control of its muscles, swaying and staggering about until finally it goes down under the increasing violence of muscular contractions. Up till this time it eats well, and seems otherwise bright and active. Cases of poisoning in this country have not in many cases been traced to Horsetail; but thorough and immediate *post mortem* examination would likely show that many obscure cases have been really due to this cause.

Destruction of Wild Mustard by Chemical Sprays.

During the year, considerable interest has been shown in the use of chemicals for the destruction of various weeds, or of weeds in general. There is something alluring in the thought of carrying on the fight in this way, instead of by the backbreaking use of the hoe, or by persistent attention to cultivation, hence the desire for information. Up to the present, we regret to say, experience has not justified us in looking to sprays for our solution of the general weed problem, as there are only a few weeds against which they have been successfully employed; and there are practically none, except wild mustard, for which we are yet prepared to recommend the spray method of treatment. As a treatment for mustard, however, it has been in use by farmers to a limited extent for a number of years, and there is no good reason why it should not be far more widely practised. Together with correct farming methods, it makes the control of this much too prevalent weed thoroughly practicable. It is not intended that spraying should take the place of cultural methods, but only that it should be an additional means of preventing the seeding of the weed, while infested land is being freed from the seeds already in it. Every effort should be made to destroy the seedlings by cultivation, before and after the period when the crop is occupying the field, but any progress which is made will be immediately lost if the mustard growing with the crop is allowed to mature its seed, and it is to prevent this that the spraying is recommended. It enables the farmer to fight the foe without giving up the use of the land in the meantime.

The spray which has been longest in use in Canada is a 2 per cent solution of copper sulphate in water, about fifty gallons to an acre being required. More recently

iron sulphate has been experimented with, and is claimed to be equally effective, and somewhat cheaper. It is usually recommended to use about 75 to 100 pounds of iron sulphate in fifty gallons of water, according to the succulence of the plants. Recent experiments in Germany have shown that a 14 per cent solution, which amounts to 70 pounds to fifty gallons of water is sufficient. Iron sulphate is much cheaper than copper sulphate, so that even the larger amount used does not make its cost so great. The solution must be applied in a fine and forcible spray so that it may cover the greatest possible area and at the same time cover the foliage thoroughly. For this purpose some form of a power spray is necessary. An arrangement which is often

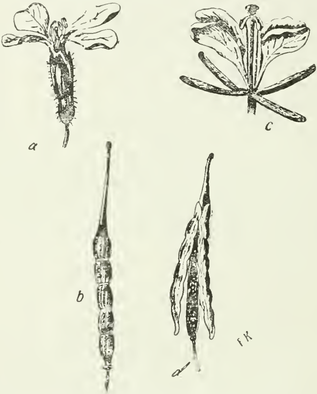


FIG. 6.—*a.* Flower. *b.* Pod of Wild Radish *(Raphanus raphanistrum.)* *c.* Flower. *d.* Pod of Wild Mustard *(Sinapis arvensis L.)*

Both plants are often mistaken for each other, but they are readily distinguished by the light yellowish flower, the tube-like calyx and segmented pods of wild radish (*a* and *b*) and the dark golden yellow flower, the open calyx and the splitting pods in the wild mustard seed.

used by large potato growers and which can be readily adapted for mustard spraying, is a spray pump with a barrel mounted on a cart, and having the necessary attachments for a series of nozzles to cover the desired width. Such a spray pump, where not already a part of the farm equipment, would be found to be a useful investment for such purposes.

The time to spray is a matter of importance, as there is little use in going to the trouble and expense of the operation after the mustard is once well into bloom. The flowers are much less easily injured than the leaves, and can often derive enough nourishment from the stems to mature the seed. The work should be done as early as possible after the mustard has all commenced to grow, and can be seen in the grain. Should rain fall immediately after spraying, much of its effectiveness will be lost;

therefore the probable weather for the next day or two should always be taken into account.

It may be as well to explain that spraying for mustard should not be attempted in crops other than the cereals. The narrow, smooth and minutely hairy leaves of the common grain crops, and the fact that the growing point is at some distance within the leaf sheaths, protects them from being easily injured, but clovers and other plants are not so safe. The possibility of destroying mustard in growing grain crops depends on this difference between them and its broad, rough, and succulent leaves.

Grass and Clover Plots.

Farmers visiting the Central Experimental Farm frequently wish to see certain grasses or clovers about which they have heard satisfactory reports. For this purpose the late Dr. Fletcher had started experimental plots showing the most important native plants, suitable for hay or fodder. These plots by means of comparison often demonstrate clearly the value of the various plauts for special yield per acre and, valuable conclusions may be drawn from these experimeuts. We also endeavour to supply information as regards the most suitable mixtures for hay or pasture land. Plots have been arranged to demonstrate the difference in appearance between 'Chess' and Wheat. Although it has been frequently proven that 'Chess' is a totally different grass from wheat and that the mysterious changes from wheat to chess never take place, there are some who are not yet convinced. Hence the plots show, especially early in the season, the characters of the different plants very well and are found very instructive. 'Chess,' (*Bromus secalinus*) is an annual grass which reproduces itself rapidly by seeds. We found that when sown in autumn and when wintering well, it has produced as much as eighteen tons of green herbage per acre. When cut before ripening its seeds, it is a fairly satisfactory haying grass.

The Herbarium and Systematic Botany.

Whenever opportunity has offered, especially during the winter months, the work of enlarging and improving the Herbarium of the Division has been proceeded with. Many species of plants which the collection lacked, have been added; and over one thousand sheets in all have been prepared and were added during the last eighteen months. These were secured mainly from (1) unmounted collections, mostly from the western provinces, made by the late Dr. Fletcher on his annual trips to the west; (2) collections, mostly of weeds, and plants of the open country, made in the neighbourhood of Ottawa during the summer of 1909, and (3) plants received from correspondents for identification, or as donations. The consultation of the Herbarium has been much simplified by re-arranging it according to the classification of Engler and Prantl, which is at present the most satisfactory, and which is adopted by the most recent Floras. The separate specimen sheets have been placed in new and more convenient wrappers, and the whole collection has found accommodation in a new and larger cabinet where it is more readily available for reference.

The necessity for a good reference collection, such as is being gradually built up, will be apparent, when it is stated that about forty collections of from half a dozen to three dozen plants each, were received during the year for naming, from teachers, and others, besides weeds and other specimens sent singly or in small numbers. The identification of this material has taken much time, especially when, as is too often the case, immature plants, or only parts of plants are sent, or when the specimens arrive in poor condition, owing to lack of care in packing. Correspondents would much facilitate our work, and often enable us to give fuller information, if they would bear this in mind. Specimens should be taken in flower whenever possible, the whole plant being preferable if it is not too large, and they should be either dried under

pressure before sending, or be packed within large leaves of some kind which will keep them fresh until they reach us.

In concluding, it gives us pleasure to acknowledge our indebtedness to Prof. John Macoun, and to Mr. Jas. M. Macoun, of the Geological and Natural History Survey, for their kind assistance in identifying specimens not contained in our own collections, particularly of western plants.

REPORT OF THE POULTRY MANAGER.

A. G. GILBERT.

OTTAWA, March 31, 1910.

Dr. WM. SAUNDERS, C.M.G.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I have the pleasure of submitting to you herewith the twenty-secoud annual report of the Poultry Division of the Central Experimental Farm.

Before giving a detailed description of the experimental work of the past year, certain features in connection with poultry production which directly affect the egg and poultry trade of the country are noted. The more important of these features may be enumerated as follows:—

An increasing scarcity of strictly new-laid eggs and of the beter quality of poultry, and reasons therefor.

Official figures are given which not only show declining exports of eggs and poultry, during the past five years, but increased imports of both commodities.

The opportunities which many farmers have of reaching the high-priced markets for eggs and poultry are commented on.

Practices on the part of some farmers in marketing eggs and poultry which prevent them from receiving the highest prices for the same are noted and remedies suggested.

The remarks of one of the largest egg and poultry buyers in Canada who states that farmers 'lose money by holding their eggs too long,' are quoted.

It is shown how a better quality of eggs and poultry may be produced by the adoption of methods which have been successfully practised in our Division for several years past.

Proper rations for laying hens and growing chickens, which are frequently asked for, are described at length.

The experimental work of the year was of its usual varied character. Among its most important features may be mentioned the following:—

Continued work in the selection, by trap nest records, of the best laying fowls.

Experiments to determine the beneficial effects of breeding from fowls of proved egg-laying worth.

The egg-laying records of fowls kept in warm and in unheated houses are given and compared.

The results of hatching by natural and by artificial means are stated.

The successful use of electricity in the hatching of chickens.

I have again the pleasure of acknowledging the assistance of Mr. Fortier in carrying on the experimental work of the year. The tables to be found in the following report, which were compiled by him, give the results of the experiments conducted under his immediate supervision. During the year, his services were called for, as poultry judge, at L'Assomption, Sherbrooke, Knowlton, Montreal, St. John's, Victoriaville and Quebec City, in the province of Quebec, and at Alexandria, Ont. He also delivered addresses at three Farmers' Institute meetings in the province of Ontario

and at eleven meetings in the province of Quebec. His attention was also given to a large correspondence in French.

Mr. R. Pelletier, who last year was appointed stenographer and typewriter to this Division, is entitled to credit for despatch and efficiency in handling a large number of letters in both English and French, received and sent out.

Mr. Summers, to whom was entrusted the collating of trap nest results, the feeding of experimental rations and other experimental work, was capable and correct.

Mr. Deavey was energetic and successful in keeping the different poultry houses aud grouuds in good order, as he was in caring for the laying stock during winter and the young chickens in summer, from the time of hatching until maturity.

I had the pleasure of attending, during the year, the following farmers' meetings and poultry shows:—Poultry meetings and show at the Industrial Exhibition, Toronto; Fat Stock and Poultry Show at Guelph, Ont.; Poultry Show at Russell, Ont.; Poultry Institute meetings at Guelph; Poultry meetings at Charlottetown and Marshfield, P.E.I.; Farmers' Institute meetings in Ontario; Ontario Fair Association annual meeting in Toronto, and other meetings at Carleton Place, Ont.; Kinburn, Ont., Truro, N.S., Moncton, N.B. and Macdonald College, Quebec.

A large and increasing correspondence, in both English and French, was an interesting feature of the year's work. The number of letters received during the year were 4,834, and the letters despatched totalled 5,773.

I have the honour to be, sir,

Your obedient servant,

A. G. GILBERT,

Manager, Poultry Division.

REPORT OF THE POULTRY MANAGER.

A conspicuous feature in connection with the production of eggs and poultry during the past year was the scarcity and high price of both products. This was notably the case during the fall and early winter months. The shortage at these periods may be traced to any, or all, of the following causes, namely:—

1. A cold and protracted spring, which seriously retarded the hatching of early chickens.

2. As a result of late hatching, the chickens were slow in growing and there was a demand for eggs and poultry in the fall months, before either the pullets had sufficiently matured to make early layers or the cockerels were in fit condition for sale for eating purposes.

3. In sympathy with the backward season, the older hens were slow in moulting and, in consequence, late in resuming egg-laying.

The protracted cold weather with its retarding influence on the early production of eggs and poultry was more general than was at first supposed. This was indicated by numerous letters received which described a similar state of affairs throughout many different sections of the country. Writing on the situation, the *Globe* of Toronto of December 7, 1909, editorially remarked: 'Quotations from various centres of prolific production show prices ranging from thirty to fifty cents per dozen, and in Toronto it is confidently prophesied that before the winter is over the price for strictly first-class eggs will be soaring in the neighbourhood of a dollar.' While the latter figure was reached in a few instances only, exceptionally high prices for strictly new-laid eggs were certainly obtained in Toronto and in other leading cities. Writing on the prevailing scarcity, the editor of the Stratford *Beacon* the first week of December last asks: 'Why should there be such difficulty in obtaining new-laid eggs in winter when the Experimental Farm Poultry Department of Ottawa has practically shown that well-fed and cared-for hens will lay well during the winter season?'

The writer of the foregoing might have added that the demand was not only for strictly new-laid eggs, but for the better quality of poultry.

Some Interesting Features of the Situation.

It is not likely that the shortage of the better quality of eggs and poultry, so acutely experienced during the past season, will be satisfactorily met until the farmers of the country give more attention to the poultry branch of their farm work. The remedy is in their own hands. That more farmers are taking greater interest in egg and poultry production is beyond question, but that their number is too limited is proved by the fact that prices have become greater rather than less. The demand is actually increasing more rapidly than the supply. The poultry and egg market in Canada is described as being unique, for the reason that, for some years past, we have had decreased exports, increased production, but, withal, increased prices. The explanation is that we have a home market of rapidly increasing value, to the requirements of which there is inadequate response. The following figures, kindly furnished by the chief officer of the Census and Statistics Office at Ottawa, show the decline in the export of eggs and poultry from Canada during the years 1905 to 1909 (both years inclusive), and the increase of imports into this country of both products during the same period:—

EXPORTS OF EGGS (HOME PRODUCE) TO ALL COUNTRIES IN THE FISCAL YEARS 1905-1909 INCLUSIVE, VALUE PER YEAR.

—	1905.	1906.	9 mos., 1907.	1908.	1909.	—
	$	$	$	$	$	
Eggs..........	712,866	495,176	556,557	301,818	124,315	A decline of $588,551 within five years.

EXPORTS OF POULTRY TO ALL COUNTRIES DURING ABOVE YEARS.

Game and poultry, living and dead....	181,874	217,944	157,677	222,012	112,579	A decline of $69,295 in five years.

VALUE OF IMPORTS OF EGGS AND POULTRY FOR HOME CONSUMPTION IN THE FISCAL YEARS 1905-1909.

Eggs............	67,559	88,937	143,184	214,994	239,127	An increase over amount imported in 1905 of $171,568.
Poultry and game..	41,400	48,494	47,956	61,762	59,483	An increase over amount imported in 1905 of $18,083.

THE DEMAND IS FOR BETTER QUALITY.

It is worthy of note that the rapidly increasing demand of the home market is for the better quality. There is an abundance of the unreliable and undesirable in eggs and poultry, but the inferior article is not wanted. It is dear at any price. For the superior quality, consumers are willing to pay the best prices, but, in return, they demand the choicest articles. At an agricultural meeting held during the past winter, one of the speakers, referring to the scarcity of the better quality of eggs and poultry, remarked: 'A great difficulty in the production of the best quality is that the farmer is not interested. In order to overcome this difficulty, the farmer must be educated to the needs of the produce market as something must be done to meet the needs of an ever-increasing demand for the superior quality. In five years we should have 25,000,000 hens to meet the estimated requirements of the market of that day.' It is gratifying to realize that the work of education referred to is surely and steadily being carried on by means of lessons and literature from our Experimental Farms system, by education at agricultural colleges and by the agricultural press. The farmers of the country have only themselves to blame if they do not know how to make the poultry department of their farms profitable.

THE GREAT BULK OF THIS SUPERIOR QUALITY SHOULD COME FROM THE FARMERS.

It has been pointed out in previous reports that the great bulk of the supply of eggs and poultry must inevitably come from the farmers of the country. And this supply is not as likely to come from the few farmers with a great many fowls each as it is from the many farmers with comparatively few hens each. The production must be general. A certain quantity of strictly new-laid eggs and of a better quality of poultry will doubtless come from poultry keepers, who usually locate in the outskirts of cities and large towns. These producers are in close proximity to the best customers, from whom they receive the highest values for the choicest articles. But

they are comparatively few in number and should not prove serious rivals to the farmer who is in a position to produce much cheaper and in greater quantity and so command the market. But until the farmers—especially those near the markets of highest prices—fully realize their opportunities and take advantage of them, so long will the specialist poultry-keeper of the city produce the much desired new-laid eggs and receive the highest prices for them.

A GREAT DRAWBACK TO FARMERS OBTAINING HIGHEST VALUES.

There are two serious drawbacks to farmers obtaining the best prices for eggs and poultry. These may be stated as follows:—

1. The pernicious habit of saving up eggs until a sufficient number is collected to make it 'worth while taking them to market.' The usual result is that the eggs first saved up are stale before reaching the purchaser.

2. An inferior quality of poultry is too often the result of allowing the young chickens 'to pick up their own living,' and in so doing develop bone, sinew and muscle rather than flesh. On a following page, it is shown how the better quality of eggs and poultry may be secured.

The difficulty of obtaining reliable eggs usually experienced by the city purchaser calls forth the following remarks from the Toronto *Globe* of December 7, 1909: 'Why should there be such a thing as stale eggs? The hen herself is as honest as she is industrious, and never has been known to lay a stale egg. And yet so much does the stale variety outnumber the fresh that it would not be an exaggeration to state the proportions as five to one. The cause of deterioration requires no profound search. The machinery for conveying it from the nest to the breakfast table is defective. While millions of fresh eggs are being brought into the world every day, there is no task that demands more vigilance on the part of the housekeeper than to get half a dozen of immaculate character to put on the breakfast table. Who will deal with this larger question? How can the law of supply and demand be made more rapid and efficient? Why stale eggs when the hens are filling the nests with fresh ones?' This grievance, noted by a leading journal of the country. is unfortunately too common in almost all cities in Canada. As already remarked, the remedy is in the hands of the farmers. They should make it a strict rule to sell on the market, to store-keeper or to private customer, none but eggs which are strictly fresh. This may be done by disposing of the eggs at least once a week and oftener, if opportunity permits.

WHAT A LEADING BUYER SAYS.

Mr. John A. Gunn, of Messrs. Gunn, Langlois & Co., Montreal, one of the largest egg and poultry purchasing firms in Canada, in a recent address before the members of the Poultry Producers' Association of Eastern Canada, said: 'It is estimated, and I think as nearly correct as possible, that there are, on an average, two dozen rotten eggs to every case, taking the season throughout. This does not include those called seconds nor the loss consequent upon cracked or broken eggs. There is no possible shadow of doubt but that fifty-one per cent of the rotten eggs could be eliminated, and if this could be done, taking eggs at eighteen cents per dozen, which was the average cost for the past season, I estimate that there would be a saving to the farmers of Canada of well over half a million dollars.'

And as to the cause for this regrettable state of affairs, Mr. Gunn said: 'Let us look for the cause. Reverting to our correspondence and also from personal knowledge, we know that a large percentage of the blame rests with the farmers. Why? For the reasons:—

1. Some farmers deliberately take to the store eggs which they know are not fresh, because the merchant is compelled to take them or lose their business.

2. Farmers take bad eggs to the market because of ignorance as to the quality of the eggs.

The foregoing remarks—from the senior partner of one of the largest wholesale egg and poultry purchasing firms in the Dominion—should be taken into serious consideration by the farmers of the country. It has been shown on a previous page that the demand for eggs and poultry of the superior quality is becoming greater every year.

CONDITIONS THE FARMERS SHOULD BE ACQUAINTED WITH.

The farmer who desires to take advantage of the rapidly developing egg and poultry markets should be fully cognizant of the following conditions which have so much to do with success, namely:—

A.—An appreciation of the fact that the requirements of the high-priced markets are for strictly new-laid eggs and a superior quality of poultry only.

B.—A thorough knowledge of how to produce the best quality of eggs and poultry wherewith to cater to the markets of high values.

C.—A keen realization that only the best will bring the highest price. Stale eggs and thin and ill-fed poultry will not receive first consideration at the hands of purchasers.

D.—Clean and new-laid eggs of equal size and same colour, placed in neat packages, are in the greatest demand.

E.—The producer who earns a reputation for selling none but reliable eggs and a better quality of poultry is not likely to lack for customers.

F.—The producer who has the best quality of eggs and poultry is in a position to demand the highest prices. His goods will stand by him. Customers are likely to come to him again.

G.—The seller of stale or doubtful eggs is not likely to make a circle of permanent customers. He may sell once but he is not likely to sell again to the same person. He is not in a position to say, 'My goods will prove their worth.'

FACTORS IN THE PRODUCTION OF THE BETTER QUALITY OF EGGS AND POULTRY.

The question is frequently asked by correspondents and others, 'How may new-laid eggs and the better quality of poultry be produced and sold to the best advantage?' Experience of many years has shown that the observance of the following rules will likely lead to a satisfactory solution of this question, namely:—

NEW-LAID EGGS IN SUMMER.

A.—Strictly new-laid eggs for summer use should come from carefully and well fed hens.

B.—To have eggs of the finest flavour, the hens which lay them should not have access to decaying animal or vegetable matter.

C.—The eggs should be non-fertilized, especially in the summer season.

D.—The nests in which the eggs are laid should be scrupulously clean.

E.—The eggs should be collected frequently and placed in a well-aired cellar or cupboard.

F.—The eggs should reach the consumer as soon as possible after being laid. The limit should not exceed a week. Better if it is only four days.

G.—For a choice retail trade, the eggs should be clean, of large and even size, and packed in neat boxes to hold one dozen each. If sold in larger quantities they should be carefully packed in clean crates. The object is to have the eggs present an

inviting appearance. Leading purveyors say that eggs so put up are most readily sold.

WINTER EGGS OF THE BEST QUALITY.

A.—Will be laid by hens which are fed on a variety of food, are free from vermin and have a well-ventilated and clean poultry house to lodge in.

B.—Eggs should be collected before they are frozen. An egg frozen and thawed out loses its flavour.

C.—They should be sold to private customers, city dealer or placed on the market within ten days of being laid.

D.—After being collected, they should be placed in a well-aired and sweet-smelling storing place.

TO SELL TO THE BEST ADVANTAGE.

A.—Select and send the choicest goods to a reliable dealer in the best paying market, which is usually a city one. (Express charges for eggs are two cents per dozen for short distances. A return charge of five cents per empty crate is made.)

B.—Some city dealers pay more for hens' eggs than for pullets', for the reason that the former are larger.

C.—The practice on the part of many farmers of holding eggs until they have a sufficient number to make it 'worth while' taking them to market, should be abandoned. It usually results in the eggs becoming stale and they are apt to receive a low valuation when sold.

D.—Farmers in the neighbourhood of cities have exceptional opportunities of reaching the best paying customers and obtaining the highest value for strictly new-laid eggs.

THE SUPERIOR QUALITY OF POULTRY.

The better quality of poultry may be produced by adopting the following methods:—

A.—Chickens must be of correct market type which implies that they must come from parentage of the same desirable type.

B.—After being hatched, the chickens require to be gently pushed by regular and generous feeding. How to correctly do so is shown on a following page.

C.—The too common practice of allowing chickens to 'pick up their own living,' or in any other way neglecting them, will seriously affect their growth and quality.

D.—Roomy coops, freedom from lice, new ground and cleanly surroundings are requisites for quick and healthy development.

E.—If the chickens are reared in brooders, care should be taken that they are not over-crowded. This undesirable treatment is too frequently the cause of disease and death.

F.—A robust chicken should eat heartily, grow well and be so handled as to put on flesh rather than develop sinew and muscle.

G.—Chickens should not be given any food for twenty-four hours before being killed. This will ensure their crops being empty of food when killed, a matter of importance.

FOWLS WHICH ARE BOTH GOOD LAYERS AND DESIRABLE MARKET TYPES.

Farmers and other poultry keepers who desire fowls which are both good egg-layers and acceptable market types will find any one of the following varieties most suitable:—

Barred, White, Buff or Partridge Plymouth Rocks.

White, Buff, Partridge or Columbian Wyandottes.

Buff, White or Black Orpingtons.

The Dorking family.
Rhode Island Reds.

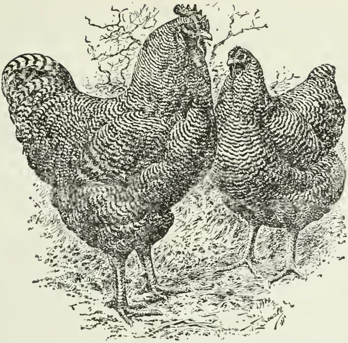
The English market prefers a bird with a white skin of fine grain, flesh-coloured legs, in good condition and carrying a liberal quantity of breast meat, such as the Orpingtons, Dorkings, &c. The Canadian purchaser is not so particular as to colour of flesh as he is to the condition of the bird, but there is a growing preference—noticeably on the part of fastidious city customers—for the white and fine-grained flesh.

The Houdans and Faverolles, which are the best known in Canada of the French varieties, have also white flesh of fine grain and are fairly good layers.

As shown in reports of several years past, the trap nest is useful in showing the fowls which are the best layers in combination with market type. Having selected a variety from the list of fowls named, it is for the farmer or poultryman to keep intact, or to develop, the egg-laying power and market type of the birds of his choice.

The following illustrations show desirable market types:—

White Orpingtons.



Barred Plymouth Rocks.

INFORMATION ASKED FOR BY FARMERS.

Notwithstanding the information conveyed in reports of previous years on the different phases of poultry keeping, frequent inquiries continue to be made as to management of fowls and rations best suited to induce winter egg-production, also as to the treatment and food best calculated to secure the steady growth and development of the chickens from hatching to marketable age. The experimental work of many winters past has shown that the following are the most important factors in securing both objects:—

1. To secure satisfactory winter egg-production, the laying stock should come from parentage of excellent egg laying records. Where it is not convenient to use trap nests, careful observation will lead to the detection of the good layers.

2. The poultry house should be dry, well lighted and ventilated. It is not necessary that it should be artificially heated. Unheated and economically constructed houses to hold 20 to 25 fowls have given satisfaction during several years use in our Division. Plans of these houses may be had on application.

3. Birds of the utility varieties—as named on a previous page—are best for the farmer. If good layers, fowls should be kept, at least, until two years of age; if of an extra good egg-laying strain, for another year.

4. It is essential to profitable egg laying in winter and to the good health of the fowls that the rations should be of a varied nature. A varied ration embraces materials which make the yolk, the white and the shell of the egg, as well as green or vegetable food and a certain amount of animal food and grit, the latter being the material with which the hen grinds up the food in her gizzard. A varied ration should be easy to secure on a farm where different grains, roots or vegetables and, at times, meat or bones are usually found in good supply. A wholesome and varied ration need not be an expensive one, but it should be fed regularly. In feeding and

managing fowls for egg production in winter, it is well to bear in mind that, if kept in close quarters during that period, they require to be artificially supplied with what they can pick up for themselves while running at large during the open season.

A POPULAR RATION.

The following ration has been found most effective in our Division in the production of eggs during winter. It should be popular on the farm as it makes use of certain forms of waste:—

Morning ration.—Table and kitchen waste, which is usually in the shape of unused porridge, potato, turnip and other vegetable peelings. These should be cooked and with them should be mixed what ground grains can be conveniently spared. The whole should be mixed into a crumbly condition and fed morning or evening in the proportion of one and a half to two ounces to each hen, the latter quantity preferably, if given in the afternoon.

Noon ration.—A small quantity of oats to be thrown into the litter on the floor of the pens, to incite the fowls to exercise.

Afternoon Ration.—Throw one and a half ounces of wheat—to each fowl—in the pens. Feed early enough in the winter afternoon, so that the birds can see to search for it in the litter on the floor. Occasionally, the morning ration should be changed to whole grain and the mash given in the afternoon. While the rations may be varied, the time of feeding should be regular. Cut bone should be given in the proportion of two pounds to every 15 fowls, three times per week, at noon, when no other food should be given.

Mangels, beets, cabbage or other roots or vegetables with other essentials such as grit, broken oyster shells, and pure drinking water should be regularly supplied.

While there is no cast iron rule as to the exact sorts of grains to use in the mash, or to be fed whole in the litter, the grains used should be clean and wholesome, the feeding done at regular hours, and vegetables or roots and other essentials unfailingly furnished.

What is desired is variety, cleanliness and regular attention with intelligent observation as to the effect of food and treatment. Experience has plainly shown that where rations embracing such variety as the one outlined have been properly used, feather-picking and egg-eating have been prevented and a satisfactory output of eggs secured.

DIFFERENT FORMS OF SOME ESSENTIAL ELEMENTS OF FOOD.

There are different forms of some apparently insignificant elements of food which are, on the contrary, all-important essentials, namely:—

Lime for egg shell making may be had in the form of old mortar or oyster and other sea shells. Ground bones and the different grains also furnish a small percentage of lime.

Grit.—In the shape of sharp gravel; flint stones, broken small; broken crockery without slivers, or the ready-made mica, granite and other commercial grits, which are sold at poultry supply houses, or seed stores, at from 85 cents to one dollar per hundred.

Cut bone.—Bone may be had in the shape of beef heads, sheep heads or green bones from a butcher. These may be broken up, or cut up (not ground), by small mills called 'bone cutters,' which are sold from $7 to $25 each, according to size.

Green food.—Is usually to be had in plenty on a farm in the shape of clover hay, unmarketable vegetables or roots, ensilage, &c. An excellent form of green food may be had in the shape of lawn clippings, dried, and steamed when required for use in winter.

DIFFERENT METHODS OF FEEDING.

There are two methods of feeding in vogue at present, namely, the 'moist' and the 'dry.' The food in the first or 'moist' method is usually composed of ground grains which are mixed with hot water into a crumbly mash and then fed in small open troughs. The second method is known as the 'hopper system,' and has become popular as it is, to a certain extent, a labour saver. By this method, whole or ground grains may be mixed thoroughly together dry and put into the hopper. By this thorough mixing of the grain, variety, which is so desirable, is secured. Some patterns of hoppers are constructed with three and four divisions; one of which may be used to hold the mixed grains; another grit; another broken oyster shells, and the fourth meat scraps. When cut bone is used, the meat scraps would not be necessary. In use in our Division, the hopper system of feeding has been found satisfactory. Where used, the hens have laid equally as well as those fed by other methods. One advantage of the hopper system is that it permits the farmer, who is usually too busy to make a mash every day, to furnish the desirable variety of food.

CHICKENS.

HOW TO FEED AND MANAGE THEM.—METHODS WHICH HAVE BEEN FOUND SUCCESSFUL.

The following methods of caring for and feeding chickens from the time of hatching by natural or by artificial means to marketable age have been practised in our Division with success for many years past.

HEN-HATCHED CHICKENS.

Chickens hatched by natural means should be allowed to remain undisturbed with the hen mother in the nest until thoroughly nest-ripe, when, with their mother they should be removed to a coop, which is placed outside on grass if possible. It is a good plan before removing the chicks to their outside quarters to feed the mother hen generously. It is to be remembered that the hens have been steadily on the nests for 36 hours, hatching out the peeping youngsters and are doubtless very hungry. Having been well fed they are more likely to brood their chickens contentedly than if in a half-starved condition. Attention to these apparent insignificant details has an important bearing on results.

A PROPER RATION FOR CHICKENS.

The following method of feeding and management of the chickens from hatching time until they reach marketable age will, if properly carried out, be found satisfactory.

First day.—The chickens should be well brooded by the hen or carefully kept from being chilled in the brooder. Hardly any food is necessary. If the chicks are hardy and show a desire for food, give stale bread crumbs, but only in small quantity. Experience has shown that newly-hatched chickens require brooding more than anything else during the first day of their existence.

Second day.—Give one part of hard boiled egg, chopped fine, mixed with three parts stale bread crumbs or stale bread soaked in milk and squeezed dry. Feed but little at a time and often.

Third day.—Continue feeding stale bread soaked in milk, but crumbly. Add finely crushed wheat or rice boiled dry, or pin head oatmeal or rolled oats. Continue this treatment for eight or ten days, when finely crushed corn may be given. After twelve or fourteen days give whole wheat.

After twelve or fifteen days, fine cut bone, in small quantity, will be much relished. A mash of shorts, cornmeal, stale bread, &c., may now be given. For drink give water or skimmed milk or both. Grit of chicken size should be placed where the chicks can get at it from the first.

On the hen-hatched chickens becoming fully feathered, their mother hens were removed from them. When well developed, both hen- and incubator-hatched chickens were removed to colony houses. At a later date the cockerels were separated from the pullets. In the case of the Mediteranean breeds it may be necessary to separate the sexes when six weeks of age.

The chickens should be well and regularly fed at the early stage of their existence, at least five times per day, but in small quantities. After five or six weeks of age, three times every day.

Growing chickens require special care during the first five or six weeks of their lives, for during that period there is a steady drain on the system of the chick for rapidly growing feathers as well as for bone, sinew and muscle. This fact is frequently overlooked.

THE BEST TIME FOR FARMERS TO HATCH OUT CHICKENS.

The best time of year for farmers to have their chickens hatch out is the first week of May. Experience has clearly shown this. Unless provided with special facilities, earlier hatched chickens are more likely to be a source of annoyance than of profit. For this reason, the hatching and rearing of early broilers is an enterprise not to be recommended to farmers, as it is not likely to be successful under ordinary farm conditions. Where broiler raising is successfully prosecuted, it is usually in the hands of experts, who use incubator rooms and brooding houses as a means of conducting their operations.

The middle of April has been found the most suitable period for farmers to place the eggs under the hens or to put them into an incubator. For the reason that, by the period mentioned, the hens usually have had an opportunity to run outside and recuperate from their long term of winter life and treatment. As a result of the renewed constitutional vigour likely to be so gained, the germs of the eggs laid by them will probably be strong and eventually hatch out in the shape of robust chickens. Many letters have been received from farmers telling of poor hatching results from early spring eggs. In such cases, the eggs have most likely been laid by hens which have not had a run outside for a sufficiently long period. In too many cases, there is reason to conclude that well-meaning but unavailing effort is bestowed on weakling chickens which, if given to the breeding stock, would be attended with more satisfactory results.

RECAPITULATION OF IMPORTANT POINTS OF INTEREST TO FARMERS WHO DESIRE TO SECURE THE HIGHEST PRICES.

Eggs to secure the best prices should be sold within a week of being laid.

It is of paramount importance that eggs sold during summer should be non-fertilized.

There is reason to believe that, owing to long keeping before being sold, the flavour of fertilized eggs is frequently impaired by germ development in the eggs.

It is said by city wholesale buyers that—in many instances—three or four weeks elapse from the time the egg is laid until it reaches the consumer in the city.

Wholesale city buyers complain of the dirty condition in which a large number of eggs reach them.

For placing of the better quality of poultry, in the very best condition, on the market, it is imperative that the crops of the chickens should be empty of all food previous to killing them. This may be accomplished by giving no food to the birds for twenty-four hours before killing them. Food left in the crop is likely to decompose and ruin the flavour of the carcass no matter how well fleshed it may be. This is an important point well worth remembering.

A QUESTION AS TO HOW TO BREED.

The question may be asked, 'If we have none but non-fertilized eggs from our hens, how then can we breed chickens?' In this way. The farmer should select 7, 9 or 11 of his best marked, best shaped and best laying hens and place them in an enclosure by themselves. Mate them with a vigorous 12 or 15 months' old male bird. Keep them together until sufficient eggs are collected for breeding purposes. The male bird should then be disposed of and the hens kept together for ten days longer, when they may be allowed to run with the other laying stock *with which there has been no male bird.* Unfertilized eggs for sale or for home use may in this way be secured Eighteen months' or two-year-old hens are the best to breed from. It is better to have the birds all of one variety than have them of mixed or nondescript types.

THE FORMATION OF CO-OPERATIVE CIRCLES.

The organization of the Producers' Poultry Association of Eastern Canada marks an important step in advance in the purchasing and selling of eggs and poultry. The aim of the Association is to promote the marketing of strictly new-laid eggs and the better quality of poultry. The consumer is perfectly willing to pay full value for the best quality of eggs and poultry. As it is, in too many cases, he pays the highest price for so-called strictly new-laid eggs to find out, after purchasing them, that they are stale. This the new Association promises to remedy. But its good offices do not end here, for it also guarantees to the producer the highest price, but only for the best articles. In other words the Association aims at bringing the producer, who has the choice articles for sale and the consumer who desires to purchase them, closer together. The following is a brief outline of the work laid out by the promoters of the newly formed Co-operative Association. 'The Association is formed with proper officers to look after the management of affairs. To defray all necessary expenses, every member pays a fee of one dollar per year. Those who join agree to sell only fresh eggs and to market them twice per week during the summer months and once a week during the cold season. The eggs are to be graded according to size and colour. Each case, or at least each tray should have eggs of the same colour and as nearly as possible of the same size. None but fresh eggs are to be marketed; any that are old, rough-shelled, or ill-shaped must not be put in the case.'

In this way, it is hoped that a better price will be paid for eggs that are carefully selected. Branches are being formed throughout the eastern provinces. In the interests of both producers and consumers it is to be hoped that the Association will meet with success.

THE EXPERIMENTAL WORK OF THE YEAR.

LIST OF BREEDING PENS.

At the end of March, 1909, the conclusion of the fiscal year, the following pens of fowls were selected and mated for breeding purposes, namely:—

No. of House	Pen Number	Breeds.	Males.	Females.	Remarks.
1	1	White Plymouth Rocks	1	16	Heated House.
1	2	Buff Orpingtons	1	14	"
1	3	White Leghorns	1	15	"
1	4	" "	1	16	" Experiment.
1	5	Black Minorcas	1	12	"
1	6	White Orpingtons	1	12	"
1	7	Faverolles	1	12	"
2	13	Black Hamburghs	1	7	"
2	16	White Leghorns	1	10	" Bad laying strain.
2	17	" "	1	10	" Good " "
2	18	" "	1	5	"
3	25	" "	1	7	"
3	26	" Plymouth Rocks	1	10	"
4	32	Buff Orpingtons	1	19	Unheated house.
5	33	Barred Plymouth Rocks	1	23	"
5	34	White Wyandottes	1	21	"
6	35	Barred Plymouth Rocks	1	20	·
6	36	White Wyandottes	1	17	"

EGGS SOLD FOR HATCHING PURPOSES.

As in previous spring seasons, numerous applications were received from many different parts of the country for eggs for hatching purposes. The surplus of eggs over the number required for our natural and artificial hatching experimental work, were sold at one dollar per setting. The eggs were carefully packed in boxes, specially made for the purpose, and sent by express to the different purchasers throughout the country.

Number of settings of eggs thus sold for hatching up to March 31, 1910, 178.

HATCHING CHICKENS BY HENS AND BY INCUBATORS.

Both artificial and natural means were used in hatching chickens. As remarked in a foregoing part of this report, the spring time of last year was peculiarly backward and it was unavoidably late before satisfactory hatching results—by either natural or artificial means—were secured. But the protracted cold weather was not without its lessons. It clearly showed:—

1. That weather conditions in spring time are factors to be reckoned with by farmers in the hatching out of chickens, under ordinary farm conditions.

2. That, should the spring season be cold and late, as it was last year, it would be better to wait for a propitious change in the weather before commencing hatching operations. By so doing, better results are likely to be obtained than if the eggs were set at an earlier but colder period.

3. That chickens of early May hatch are likely to make steadier growth than chickens hatched a month or six weeks earlier in colder weather.

The first eggs to be set were placed under and hatched by hens, at different periods, beginning on April 10 last as shown by the following table:—

TABLE I.—SHOWING NUMBER of Eggs Set and Chickens Hatched by Hens.

Date Eggs were Set.	Description of Eggs.	No. of Eggs.				Chickens.		Percentage hatched.		Remarks.
		Set.	Broken by hens.	Clear.	With dead germs	Dead in the shell	Hatched.	From total eggs set.	From fertilized eggs.	
1909.										
April 10...	Black Minorcas, Buff Orpingtons, B. P. Rocks, White Wyandottes..........	90	0	32	14	14	30	33⅓	68⅕	Eggs were laid by hens which were kept in unheated and in warmed houses.
May 1...	Black Hamburgs, White Orpingtons, White Plymouth Rocks and B. P. Rocks.	98	3	11	15	22	47	48	68	
" 13...	Buff Orpingtons, Barred Plymouth Rocks, White Leghorns, White Wyandottes...	30	2	4	5	5	14	46⅔	73⅔	
	Total	218	5	47	34	41	91	41⅘	69	

All the above hens sat steadily on the eggs given to them and, when the chickens were hatched, made excellent mothers.

HATCHING CHICKENS BY ELECTRICITY.

Hatching chickens by means of heat obtained from the electric wires used for lighting the poultry houses was again successfully accomplished, on two occasions, during the season. The eggs were placed in a small 60-egg incubator from the Cyphers Manufacturing Company, of Buffalo, N.Y., U.S.A., and arranged so as to utilize electricity as a heating medium. The electricity used was, in quantity, enough to supply a 16 candle power house lamp. The machine, which is known as an 'electrobator,' was easy and convenient to operate and kept up the requisite temperature of 103 degrees with remarkable correctness. Results are shown in the following table:—

TABLE 2.—SHOWING NUMBER of Chickens Hatched by Electrobator.

Date when Eggs were placed in Incubator.	Description of Eggs.	No. of Eggs.			Chickens.		Percentage hatched.		Remarks.
		Set.	Clear.	With dead germs	Dead in shell.	Hatched.	From total eggs set.	From fertilized eggs.	
1909.									
May 1.....	Buff Orpingtons, Barred Plymouth Rocks and White Leghorns	62	16	11	9	26	42	74⅓	Eggs were laid by hens kept in cold houses except those of the White Leghorns.
" 29..	Buff Orpingtons, Barred Plymouth Rocks and White Wyandottes.....	64	17	4	7	36	56¼	83¾	

After being hatched, the chickens were placed in a brooder, also heated by electricity, and made satisfactory progress. The apparatus used for heating the brooder is known as an 'electrohover.' The temperatures, in both instances, were kept with great regularity.

HATCHING BY COAL OIL LAMP HEATED INCUBATORS.

A number of eggs were also placed in ordinary incubators with following results:—

TABLE 3.—SHOWING NUMBER of Chickens Hatched by Incubator Heated with Coal Oil.

Date Eggs were placed in Incubator.	Description of Eggs.	No. of Eggs. Set.	Clear.	With dead germs	Chickens. Dead in shell.	Hatched.	Percentage Hatched. From total eggs set.	From fertilized eggs.	Remarks.
1909.									
May 4.....	B. Orp., B. P. Rocks, Wh. Wy., Wh. Leg..	110	32	21	18	39	35½	68⅓	Eggs were laid by hens kept in both unheated and in warmed houses.
" 11. ..	" " " " "	96	32	15	9	40	41⅔	81⅔	
" 15.....	Wh. P. R., Wh. Wyandottes..	100	34	20	16	30	30	65¼	
June 1....	B. Orp., B.P.R., Wh. Wy., B M.	107	29	10	19	49	45¾	72	
	Total	413	127	66	62	158	38⅕	71¾	

The hens which laid the eggs as described above were unavoidably confined to limited runs and had to be artificially supplied with green food as were the birds mentioned in previous tables 1, 2, and following table 4.

EGGS FROM GOOD LAYERS HATCH STRONG CHICKENS.

The following Table, No. 4, shows the number and the vitality of chickens hatched out of eggs laid by an excellent egg-laying strain of White Leghorn fowls in comparison with other chickens hatched from eggs laid by a poor egg-laying strain of fowls of the same variety and of the same family. The fowls of both strains were kept in the same building—House No. 2—and were fed on the same rations in both cases. It will be noticed that there is a marked difference in the vitality of the chickens, and results are altogether in favour of the better egg-laying strain of birds. The hatching medium was hens in both cases.

TABLE 4.—SHOWING THE NUMBER of Chickens Hatched from Eggs laid by Good and Poor Egg-Laying Strains of White Leghorn Fowls and the great difference in the vitality of the same.

Date Eggs were set.	Description of Eggs. White Leghorns.	No. of Eggs Set.	Clear.	With dead germs	Chickens. Dead in shell.	Hatched.	Percentage Hatched. From total eggs set.	From fertilized	Remarks.
1909.									
May 20. ...	Poor laying strain.	30	9	9	7	5	16⅔	41⅔	Weak from time of hatching.
" 20	Good laying strain	30	3	3	4	20	66⅔	83⅓	Strong and made vigorous growth.

INCUBATOR-HATCHED CHICKS FOR FIRST TEN DAYS REQUIRE GREAT CARE.

The following table is intended to show that incubator-hatched chickens, particularly during the first ten days of their existence, should be protected from risk of chill which is frequently caused by exposure to cold or dampness, irregular temperatures in the brooder, or from being let out too early in the morning on dew-covered grass. Two groups of chickens, marked A and B, after close observation, were chosen as furnishing data calculated to be useful in the early treatment of newly-hatched chickens.

TABLE 5.—SHOWING THE PROGRESS made by Two Groups of Newly-hatched Chickens which were placed in two separate Brooders. The Chicks in the case of Group A. were carefully protected from risk of chill. Group B. Chickens were kept for part of a day, during two weeks, outside of the Brooder and were evidently chilled.

Date when Chickens were put in Brooders.	Groups.	Varieties.	No of Chickens in each Brooder.				Causes of Death.			Remarks.
			First day.	Tenth day.	Twentieth day.	Thirtieth day.	Chalky Diarrhoea.	Weakness.	Accident.	
May 13.	A.	B. Orp., Blk. Min., B. and Wh. P. Rocks ..	58	54	53	52	0	4	2	Strong and made rapid growth.
" 20...	B.	Wh. Leg. and Wh. Wyandottes...........	52	20	18	15	33	4	0	Made slow growth and many died from white or chalky diarrhoea. Presumably chilled.

WARMED vs. UNHEATED HOUSES.

EGG-LAYING RESULTS FROM GROUPS OF FOWLS KEPT IN WARMED AND IN UNHEATED HOUSES.

The following four tables give results in egg laying by different groups of fowls placed in artificially warmed and also in unheated houses, during the past year. This interesting line of experimental work was commenced a few years ago and the data so far obtained are much in favour of the unheated houses. Particularly valuable is the experience gained from the favourable effects of the unheated, or cotton front style of fresh-air house on the production of eggs and the general health of the fowls, during the winter season. The introduction of the unheated house principle in all its different adaptations of colony, or cotton front or other patterns, may be said to have revolutionized the methods of poultry keeping which for so many years have been in vogue. The following tables, 6, 7 and 8, show egg-laying results from fowls kept in artificially-warmed houses.

TABLE 6.—SHOWS THE NUMBER of Eggs laid by 13 White Plymouth Rock Hens, for Twelve Months. The Birds were kept in Pen No. 1 of No. 1 Poultry House, which was artificially warmed by means of a stove. The Fowls were in their second year.

Thirteen White Plymouth Rock Hens. — 2 years old.	1908.		1909.										Total number of eggs laid during the year.	Remarks
	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.		The pen in which these fowls were kept was in a building artificially heated.
Eggs laid per month	0	35	115	67	107	176	187	81	38	20	18	3	847	Average—65 eggs each.

TABLE 7.—SHOWING NUMBER of Eggs laid by 4 Hens and 8 Pullets of Buff Orpingtons. Fowls were kept in Pen No. 2 of No. 1 House, which was artificially warmed.

Buff Orpingtons. 4 hens and 8 pullets—12.	1908.		1909.										Total of eggs laid during the year	REMARKS.
	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.		Best hen laid 79 eggs. Poorest hen laid 12 eggs.
Eggs laid per month ...	3	41	61	56	82	110	49	60	26	0	7	0	498	Average 41½ each.

RATIONS FED TO ABOVE HENS.

Morning and Evening.—Whole grain: ½ wheat, ½ oats. Thrown in the litter on floor of house.

Noon.—Ground grain fed dry: 1 part corn, 1 part barley, 1 part oats, 1 part wheat bran.

2. Every third day: Ground raw bone. After April 20 replaced by meat scrap, one part of which was mixed in the dry feed.

3. Every third day (in winter) raw vegetables. There was a constant supply of gravel and oyster shells.

TABLE 8.—SHOWING THE EGG RECORD of 11 White Leghorn Pullets hatched on the 20th of May, 1908, for twelve months. The Birds were kept in Pen No. 3 of No. 1 house, which was artificially warmed.

11 White Leghorn Pullets.	1908.		1909.										Total of eggs laid during the year.	REMARKS.
	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.		Hatched out May 20.
Eggs laid per month.. . .	2	84	96	53	130	172	131	34	9	0	11	0	722	Average 65½ each.

EGG-LAYING IN UNHEATED HOUSES.

TABLE 9.—THE GROUP of fowls in this case was composed of 11 hens and 5 pullets of the Buff Orpington variety. These birds were kept in an unheated house with a cotton frout which is, at present, one of the most popular patterns of a modern poultry house.

Buff Orpingtons. 11 hens. 5 pullets.	1908. November.	December.	1909. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	Total of eggs laid during the year.	Remarks. Best hen laid 140 eggs. Poorest " 45 "
Eggs laid per month......	14	69	82	189	189	152	177	127	72	59	69	11	1,208	Average 75½ each.

The above fowls were of the same age and were fed the same rations as were the inmates of Pen No. 2 of No. 1 house. The composition of the ration is shown in tho preceding table No. 7, with which the results in this case should be compared. The striking difference will be noted that the best layer in this unheated house gave a yield of 140 eggs in the year, as compared with 79 of the best layer in a warmed house as shown in table No. 7.

The following table will be read with interest as showing the average number of eggs laid by fowls of different varieties, which were kept in houses of different patterus but all unheated.

TABLE 10.—RECORDS THE NUMBER of eggs laid by the fowls of the different varieties which are described in the following table, from November 1, 1908, to October 31, 1909. The birds were all inmates of 'unheated houses.'

Breeds.	Hens or Pullets.	Description of house.	Total of eggs laid in 12 months.	Average of eggs laid.	Remarks.
10 Barred Plymouth Rocks..	Hens.....	Cold.......	830	83	The birds during the winter season were in excellent health.
16 White Wyandottes.....	"	"	1,193	74¼	
14 Barred Plymouth Rocks..	Pullets...	"	1,245	89	
13 White Wyandottes......	" ...	"	1,016	78	

Rations fed were the same as described in table No. 7.

Some of the heus of each of the above varieties were used as sitters and mothers to hatch and rear chickens during the summer season.

SELECTION OF GOOD EGG LAYERS.

PERCENTAGES OF IMPROVEMENT IN EGG LAYING, SECURED BY TRAP-NEST SELECTION.

The work of selecting and breeding from good egg-laying strains of fowls is most interesting and important. The following table shows the percentages of improvement made, in certain breeds of fowls, in four years by means of selection by trap-nests of the best layers and by breeding from them. The work of selecting the good

from the poor egg layers, by means of trap nests, commenced in the year 1905 and is still going on. As remarked in a previous report, the work of developing prolific egg-laying strains of fowls is unavoidably slow and is rendered still more difficult where a large number of fowls are kept. A busy farmer is not likely to have time to attend to any more than a limited number of hens by the trap-nest method and it is doubtful if it will ever become popular with him. Although mechanically correct in securing results, it is a system demanding unflagging attention, for at least the fore part of the day and entailing the keeping of correct records of both male and female lineage. On several occasions during the work of selection, male birds were purchased from outside sources. These birds had no guaranteed pedigree and there is reason to conclude that their use retarded rather than forwarded the work of breeding prolific egg-layers. It is most important that the male birds used as breeders should come from a prolific egg-laying strain of females.

TABLE 11.—SHOWING THE PERCENTAGE RESULTS of four years' breeding from fowls of excellent egg-laying record as proved by the use of trap-nests. The record of both hens and pullets are given. The birds were kept in artificially warmed and in unheated houses.

Breeds.		1905.		1906-07.		1907-08.		1908-09.		1909-10.	
		Kept in a heated house.	Kept in a cold house.	Heated house.	Cold house.	Heated house.	Cold house.	Heated house.	Cold house.	Heated house.	Cold house.
Barred Plymouth Rocks.	Hens	62½	.....	....	76	65	70	61⅓	83	......	83
	Pullets...	...	63½	65¾	58	50½	68½	......	69½	......	89
White Plymouth Rocks..	Hens	......	.....	......	......	54	......	......	.....	65	....
	Pullets...	....	......	50½	......	......	......	71½	.....	.....	......
White Leghorns	Hens	44	......	75	......	53	......	71	......	....	......
	Pullets...	80½	......	77½	....	65	......	66	......	65½	....
White Wyandottes... ..	Hens	57⅕	.....	......	74⅓	.....	104	......	97	......	74½
	Pullets...	.....	62¾	....	60¼	......	74¾	......	80	......	78
Buff Orpingtons..	Hens	64	......	56⅔	.....	50	.	62⅓	......	41½	75½
	Pullets...	62½	......	58	......	52½	......	.....	93	......	......

MINOR DETAILS OF THE YEAR'S WORK.

During the fall and winter seasons the following birds were disposed of for breeding and eating purposes, namely:—

Males for breeding.	44
Females for breeding.	52
Culls or mixed breed males sold for table use.	41
Culls or mixed breed females sold for table use.	28
Number of eggs sold for eating purposes.	584 doz.
Number of eggs sold for hatching purposes up to March 31, 1910.	178 settings.

WHEN THE PULLETS COMMENCED TO LAY.

The pullets of the different varieties began to lay in the following order and at the dates specified, namely:—

White Leghorn pullet commenced to lay December 1, 1909.
Buff Orpington pullet commenced to lay December 4, 1909.
Black Minorca pullet commenced to lay December 3, 1909.
B. Plymouth Rock pullet commenced to lay December 13, 1909.
White Wyandotte pullet commenced to lay December 15, 1909.

NUMBER OF EGGS LAID DURING THE YEAR.

The following is a list of the number of eggs laid during the different months of the year, dating from April 1, 1909, to March 31, 1910:—

1909.—April	2,623
May	2,573
June	1,187
July	575
August	309
September	124
October	47
November	189
December	611
1910.—January	888
February	996
March	2,651
Total	12,773

ACKNOWLEDGMENT

I have to acknowledge the kindness of Dr. Higgins, Pathologist of the Veterinary Laboratory, Experimental Farm, in making *post mortem* examinations of young and old birds which died during the year. His determinations as to cause of death (which was, as a rule, due to disorders of the stomach and intestines) were of service to our Division in regulating the quantities of food to be given at different seasons of the year.

STOCK ON HAND ON MARCH 31, 1910.

Pen No.	Breeds.	Cocks.	Hens.	Cockerels.	Pullets.	Total.	Remarks.
1	White Plymouth Rocks	......	14	1	......	15	
2	" "	......	......	1	13	14	
3	White Leghorns	1	28	....	......	29	Good egg laying strain.
5	" "	1	......	......	14	15	" "
7	Faverolles	......	8	....	......	8	
16	White Leghorns	1	6	......	3	10	Poor egg laying strain.
18	Barred Plymouth Rocks	......	......	1	5	6	Special laying strain.
20	Buff Orpingtons	1	.....	....	7	8	
26	Black Minorcas	1	10	......	5	16	
32	Buff Orpingtons	1	22	..	.....	23	In cotton front house.
33	White Wyandottes	.....	21	1	......	22	In cold house.
34	Barred Plymouth Rocks	.....	29	1	......	30	"
35	" "	1	......	.....	28	29	"
36	White Wyandottes	1	......	......	20	21	"
	For breeding and eating purposes	16	13	......	24	53	In different pens.
	Capons	......	.....	2	......	2	
	Totals	24	151	7	119	301	

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES

REPORT OF R. ROBERTSON, SUPERINTENDENT.

NAPPAN, N.S., March 31, 1910.

To Dr. WM. SAUNDERS, C.M.G.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith the twenty-second annual report of the operations on the Experimental Farm for the maritime provinces, at Nappan, N.S., for the year ending March 31, 1910.

The summer season of 1909 was one of the most favourable for the growing of farm crops experienced here for some time.

Following a backward spring, seeding began unusually late, the weather being cold and wet until May 23. After this, no rain fell here until June 28. The first seeding was done on May 25, but, on account of the steady dry and cool weather throughout, the last was sown quite as early as usual, on June 23. From this out, the season was one of the very best seen here for some years. Alternate dry and wet spells came at about the right times until the beginning of September, when rainy weather set in, and continued with short intervals of a few days at a time, making it extremely hard to proceed with the gathering of the crops and with other fall work.

Grain crops ripened rather rapidly. The yields are barely up to the average, but roots (particularly turnips) were unusually good. Corn was but little above the usual crop. Hay and grass were both better than usual. The apple crop was not nearly as good as in past years.

I again desire to acknowledge the services of Mr. Thomas Coates, farm foreman, and of Mr. Robert Donaldson, herdsman, who have so ably assisted me in their respective departments, practically all the records having been kept by them.

EXPERIMENTS WITH SPRING WHEAT.

Fourteen varieties of spring wheat were sown in uniform test plots of one-fortieth acre each. The land was a clay loam on which ensilage corn had been grown the previous year (1908), for which crop, barnyard manure at the rate of 20 tons per acre had been applied. No manure or other fertilizer was used for this crop.

The land was ploughed in the fall of 1908, and well worked up in the spring (1909) and sown May 25, with seed selected from picked heads of the previous year's crop, sown at the rate of 1¾ bushels per acre, together with Common Red clover, 7 lbs., Alsike clover, 3 lbs., and timothy seed, 12 lbs., per acre.

Cold, dry weather for at least one month subsequently to the sowing caused rather a poor growth at the first, while weeds got more than a usual start over the crop.

There was a little rust on the following varieties: Hungarian White, Marquis, Riga, Bobs and Stanley, the last (Stanley) being affected quite badly.

The following were the yields obtained:—

SPRING WHEAT.—Test of Varieties.

Number.	Name of Variety.	Date of Ripening.	No. of days Maturing.	Average length of Straw, including Head.	Character of Straw.	Average length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Inches.		Inches.		Lbs.	Bush.	Lbs.	Lbs.
1	Pringle's Champlain....	Sept. 7	99	44 to 48	Stiff......	2½ to 3	Bearded. ..	3,080	34	..	56½
2	Bishop..............	" 7	99	42 " 46	"	2½ " 3	Beardless...	2,880	34	..	56¾
3	Bobs..	" 1	93	36 " 40	"	2½ " 3	" ...	2,920	31	20	58
4	Chelsea.....	" 1	93	35 " 38	"	2½ " 3	" ...	2,840	30	..	58¼
5	Huron...	" 7	99	36 " 40	"	2 " 3	Bearded. ...	3,160	29	20	58¼
6	Hungarian White......	" 3	95	36 " 40	" .. .	2½ " 3	" ...	2,720	28	40	59
7	Red Fife......	" 11	103	43 " 46	"	2 " 3	Beardless..	3,240	28	..	56
8	White Fife.	" 11	103	40 " 42	"	3 " 3½	" ...	3,040	26	40	58
9	Preston...............	" 5	97	36 " 40	"	2½ " 3	Bearded....	2,640	24	40	57½
10	Percy.................	" 7	99	40 " 44	"	2½ " 3	Beardless...	3,120	24	20	55
11	Marquis....	" 7	99	40 " 44	"	2 " 3	" ...	2,680	24	..	58
12	White Russian...... ...	" 11	103	37 " 42	"	2 " 3	" ...	[illegible]	23	20	57¾
13	Riga................ .	" 5	97	38 " 40	"	2 " 3	" ...	[illegible]	21	20	58½
14	Stanley....	" 7	99	38 " 42	"	2½ " 3¼	" ...	2,960	20	40	57

EXPERIMENTS WITH DURUM OR MACARONI WHEAT.

Four varieties of Durum or Macaroni wheat were grown in uniform test plots of one-fortieth acre each.

The land was similar to, and received the same treatment as, the spring wheat plots, and was sown May 26.

The following were the yields obtained:—

MACARONI OR DURUM WHEAT.—Test of Varieties.

Number	Name of Variety.	Date of Ripening.	No. of days Maturing.	Average length of Straw, including Head.	Character of Straw.	Average length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Inches.		Inches.		Lbs.	Bush.	Lbs.	Lbs.
1	Roumanian.	Sept. 13	105	34 to 38	Stiff	2 to 2½	Bearded....	2,920	25	20	57½
2	Goose............	" 7	99	32 " 36	"	1½ " 2¼	" ...	2,440	24	..	58
3	Mahmoudi	" 7	99	32 " 36	"	1½ " 2	" . .	2,480	20	..	54¾
4	Yellow Gharnovka. ...	" 13	105	30 " 35	"	2 " 2½	"	2,400	18	..	60½

EXPERIMENTS WITH EMMER AND SPELT.

Two varieties each of Emmer and Spelt were sown May 26 in plots of one-fortieth acre each.

The land was similar to that on which the other spring wheats were sown, and received the same treatment.

The yields from these plots are given in pounds, as, with the ordinary threshing, the chaff is not separated from the kernels and the result cannot well be compared with the other sorts of wheat which are threshed clean.

The following were the yields obtained:—

EMMER AND SPELT.—Test of Varieties.

Number.	Name of Variety.	Date of Ripening.	No. of days Maturing.	Average length of Straw, including Head.	Character of Straw.	Average length of Head.	Kind of Head.	Yield per Acre.
				Inches.		Inches.		Lbs.
1	White Spelt	Sept. 13	111	36 to 40	Stiff	3 to 4	Beardless	1,600
2	Common Emmer	" 1	99	30 " 33	"	1½ " 2	Bearded	1,480
3	Red Spelt	" 13	111	33 " 38	"	3 " 4	Beardless	1,400
4	Red Emmer	" 13	111	36 " 40	"	2 " 2½	Bearded	1,360

EXPERIMENTS WITH OATS.

As in other years, experiments were conducted with the leading varieties of oats, which were grown in uniform test plots of one-fortieth acre each. Twenty varieties were included in this test. The plots all received the same treatment as to cultivation and were on soil fairly uniform throughout.

The ground was a heavy clay loam, on which ensilage corn had been grown the previous year (1908) for which crop, barnyard manure at the rate of 20 tons per acre had been used. The land was ploughed in the fall (1908) and harrowed in the spring (1909) with the spring-tooth and smoothing harrows until a fine tilth was made. The seed was then sown at the rate of 2½ bushels per acre. Clover and Timothy was also sown at the rate of, Common Red clover, 7 lbs., Alsike clover, 3 lbs., and Timothy seed 12 lbs. per acre, by means of a grass seed attachment to the grain seeder. The seed oats used were from selected heads of the previous season's crop, cut from the various plots at harvest time, and sown May 25. No fertilizer of any kind was used on these plots. The grain started slowly on account of the unusually cold and dry weather, which continued for about one month after the sowing of the crop, the result being a somewhat lower yield than usual.

There was considerable rust in all cases, but no variety specially affected, with very little smut.

The following yields were obtained:—

OATS.—Test of Varieties.

Number.	Name of Variety.	Date of Ripening.	No. of days Maturing.	Length of Straw, including Head.	Character of Straw.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Inches.		Inches.		Lbs.	Bush.	Lbs.	Lbs.
1	Banner	Sept. 3	101	36 to 40	Stiff	6 to 8	Branching..	4,040	56	16	34
2	White Giant....	" 1	99	36 " 40	"	6 " 7	" ...	3,680	52	32	34
3	Virginia White.	" 1	99	33 " 36	"	5 " 6	" ...	3 720	51	26	32
4	Abundance.	" 3	101	36 " 40	"	6 " 8	" ...	3,880	50	..	34¼
5	Milford White.	" 3	101	40 " 44	"	7 " 8	Sided.......	3,920	49	14	37
6	Danish Island	" 1	99	33 " 38	"	5 " 7	Branching..	3,760	49	14	34
7	Kendal White	" 3	101	37 " 40	"	6 " 8	" ...	3,800	48	08	33
8	American Triumph	" 13	111	44 " 48	" ..	7 " 8	" ...	3,760	48	08	35
9	Lincoln..........	" 3	101	35 " 38	"	5 " 7	" ...	3,720	47	22	33
10	Irish Victor	" 3	101	34 " 38	"	6 " 8	" ...	3,4[illegible]0	47	22	34½
11	Golden Beauty.	" 1	99	35 " 40	"	5 " 7	" ..	3,800	47	02	34
12	Siberian...	" 3	101	33 " 42	"	7 " 9	" ...	3,680	47	02	36½
13	Wide Awake....	" 1	99	38 " 42	"	6 " 8	" .	3,520	46	15	33
14	Twentieth Century.....	" 1	99	36 " 40	"	6 " 8	" ...	3,520	45	30	33
15	Thousand Dollar. ...	" 1	99	35 " 38	"	6 " 8	" . .	3,640	45	30	33
16	Swedish Select....	" 3	101	34 " 36	"	7 " 8	" .	3,480	44	24	32
17	Improved American....	" 11	109	40 " 43	"	6 " 8	" ..	3,520	42	32	35¼
18	Improved Ligowo.....	" 1	99	36 " 40	"	6 " 7	" ..	3,440	42	12	30½
19	Pioneer.	Aug. 31	98	36 " 38	"	6 " 8	" .	3,440	41	26	34¼
20	Storm King....... .	Sept. 1	99	40 " 44	"	6 " 9	Sided.......	3,520	41	06	35¼

FIELD CROP OF OATS.

Three acres of oats were grown in one lot. The field was a clay loam in rather a good state of fertility, having grown hay the previous year, for which crop a dressing of barn-yard manure, at the rate of 20·tons per acre had been used as a top dressing, spread on in winter.

On account of the continued cold, dry weather after sowing, this crop made rather a slow start, while weeds got more than a usual advantage over the crop.

By July 1, some rust was noticed, which continued to increase until the whole crop was badly affected. It yielded 84 bushels, being at the rate of 28 bushels per acre.

The seed was sown May 27, and cut September 8.

FIELD CROP OF OATS ON MARSH.

Seven acres of oats were grown on ordinary marsh or dyke land, on which timothy hay had been grown for a term of years previously. This land was ploughed in the fall of 1908 and sown June 3, 1909.

This crop made only a fairly good growth, and was cut from September 16 to 25, but, owing to the extremely wet weather, was not at the time got in. While the oats were cut, but still in the field, a very exceptionally high tide arose, claimed to be the highest since the famous Saxby tide 40 years ago, breaking much of the dykes, flooding the marshes, and destroying very much of this crop, which was eventually got in in an almost ruined condition, and from which 131 bushels was obtained, no record being possible of the yield of individual acres.

EXPERIMENTS WITH BARLEY.

Experiments were conducted in uniform test plots with twenty varieties of barley (ten of six-rowed and ten of two-rowed) in plots of one-fortieth acre each.

The land was a heavy clay loam on which ensilage corn had been grown the previous year (1908), for which crop barn-yard manure at the rate of 20 tons per acre had been used.

No manure or other fertilizer was used for this crop.

The land was ploughed in the fall of 1908 and thoroughly worked up in the spring with spring-tooth and disc harrows, and sown May 26, at the rate of 2 bushels per acre, together with 7 lbs. Common Red clover, 3 lbs. Alsike clover, and 12 lbs. Timothy seed per acre.

The seed used was from selected heads of the previous year's crop.

There was more or less smut but no rust.

The following were the yields obtained:—

Six-rowed Barley.—Test of Varieties.

No. of Plot.	Name of Variety.	Date of Ripening.	No. of Days Maturing.	Length of Straw, including Head.	Character of Straw.	Length of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Inches.		Inches.	Lbs.	Bush.	Lbs.	Lbs.
1	Stella	Aug. 30.	96	36 to 40	Stiff	2 to 2¾	3,320	55	..	47
2	Mensury	" 26.	92	34 " 38	Medium	2½ " 3	3,240	51	32	44¾
3	Odessa	" 23.	89	35 " 38	"	2 " 2½	2,880	48	12	46⅓
4	Yale	" 30	96	35 " 40	"	2¼ " 3	3,160	48	04	45⅓
5	Trooper	" 24	90	33 " 36	"	2 " 2½	3,120	47	24	45⅔
6	Nugent	" 24.	90	36 " 40	Stiff	2 " 2¾	3,040	46	32	46¾
7	Oderbruch	" 23.	89	36 " 40	Medium	2 " 2½	2,840	46	12	46
8	Albert	" 25.	91	34 " 38	Stiff	2 " 2½	2,920	45	40	48
9	Mansfield	" 26.	92	36 " 40	"	2½ " 3	2,960	43	16	46½
10	Claude	" 25.	91	36 " 40	"	2 " 2½	2,720	40	40	47½

Two-rowed Barley.—Test of Varieties.

Number.	Name of Variety.	Date of Ripening.	No. of Days Maturing.	Length of Straw, including Head.	Character of Straw.	Length of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Inches.		Inches.	Lbs.	Bush.	Lbs.	Lbs.
1	Swedish Chevalier	Aug. 31.	97	34 to 38	Weak	3 to 4	2,960	58	16	46
2	French Chevalier	" 31.	97	36 " 38	Medium	3 " 4	3,080	55	00	47
3	Danish Chevalier	" 31.	97	36 " 40	"	3 " 3½	2,840	49	08	47
4	Canadian Thorpe	" 30.	96	38 " 41	Stiff	2½ " 3	2,720	47	24	46
5	Beaver	" 30	96	37 " 40	Medium	3 " 4	2,680	45	40	47
6	Invincible	" 30	96	40 " 44	Stiff	3 " 3½	2,880	41	12	48
7	Gordon	" 30.	96	38 " 42	"	2⅓ " 3	2,760	40	40	46⅓
8	Clifford	" 30.	96	38 " 42	"	2½ " 3¼	2,800	40	00	47½
9	Standwell	" 30.	96	38 " 42	"	2½ " 3	2,640	39	08	44
10	Jarvis	" 30.	96	36 " 41	"	2½ " 3	2,520	30	40	49¾

FIELD CROP OF BARLEY.

One acre of Odessa barley was grown on a heavy clay loam, the previous crop having been mangels, for which crop barn-yard manure at the rate of 20 tons per acre had been used.

This, like all the rest of the early sown grain, owing to the continued cold and wet weather, made rather a poor start, while weeds got rather an unusual advantage over the crop.

The seed was sown May 28, and yielded 23 bushels.

EXPERIMENTS WITH PEAS.

Sixteen varieties of peas were sown, in uniform test plots of one-fortieth acre each, on a clay loam soil (largely clay), on which turnips had been grown the previous year (1908), for which crop barn-yard manure at the rate of about 20 cart loads per acre had been used. The land was ploughed in the fall, well worked up in the spring and sown June 5 with the seed drill, at the rate of from 2 to 3 bushels per acre, according to the size of the pea. At the same time, it was seeded with Common Red clover, 7 lbs., Alsike clover, 3 lbs., and Timothy seed 12 lbs. per acre.

This crop, although starting slowly, made quite satisfactory growth.

The following yields were obtained:—

PEAS.—Test of Varieties.

No. of Plot.	Name of Variety.	Date of Ripening.	No. of days Maturing.	Length of Pod.	Size of Pea.	Yield per Acre.		Weight per Bushel.
				Inches.		Bush.	Lbs.	Lbs.
1	Large White Marrowfat	Sept. 16	103	2 to 3	Large	26	..	63
2	Daniel O'Rourke	" 13	100	2 " 2½	Small	23	20	63
3	Mackay	" 17	104	2 " 3	Large	21	20	63½
4	Paragon	" 17	104	2 " 2½	Medium	20	..	63¾
5	Picton	" 16	103	2 " 3	"	19	20	63
6	Prince	" 16	103	2 " 3	"	19	..	62½
7	Prussian Blue	" 14	101	1½ " 2	Small	18	40	64
8	Black-Eye Marrowfat	" 17	104	2 " 2½	Medium	18	..	62½
9	Early Britain	" 15	102	2 " 2½	"	17	20	61
10	Arthur	" 15	102	2 " 2½	"	16	40	63½
11	Wisconsin Blue	" 15	102	2 " 2½	"	16	..	63
12	Chancellor	" 13	100	1½ " 2	Small	15	20	64
13	Golden Vine	" 13	100	1½ " 2	"	14	40	62¼
14	Gregory	" 15	102	2 " 2½	Medium	14	..	63
15	English Grey	" 15	102	2 " 2½	"	13	20	58½
16	Victoria	" 18	105	2 " 2½	"	11	20	62

EXPERIMENTS WITH BUCKWHEAT.

Five varieties of buckwheat were sown in uniform test plots of one-fortieth acre each. The ground was a heavy clay loam on which ensilage corn had been grown the previous year (1908), for which crop barn-yard manure at the rate of 20 tons per acre had been used.

The seed was sown June 5 and cut September 3.

No manure or fertilizer was used for this crop.

The following yields were obtained:—

Buckwheat.—Test of Varieties.

Number.	Name of Variety.	No. of days maturing.	Average length of Straw including Head.	Yield per Acre.		Weight per measured Bushel after Cleaning.
			Inches.	Bush.	Lbs.	Lbs.
1	Tartarian	90	34 to 38	40	40	50
3	Silver hull	90	36 " 40	40	20	51
3	Japanese	90	36 " 40	40	..	48
4	Grey	90	34 " 38	39	08	50
5	Rye-Buckwheat	90	36 " 40	38	16	50

FIELD CROPS OF BUCKWHEAT.

Eight acres of buckwheat were grown, seven acres of which was Silverhull, and one acre Grey.

The land was a sandy loam in rather a poor state of fertility, the previous crop having been hay.

The seed was sown June 17 and yielded:—Silverhull, 25 bushels 20 lbs. per acre; Grey, 25 bushels per acre; a total of 202 bushels, 20 lbs.

EXPERIMENTS WITH INDIAN CORN.

Thirteen varieties of Indian corn for ensilage were sown in uniform test plots. The land was a sandy loam on which timothy hay had been grown the previous season. Barn-yard manure at the rate of 20 tons per acre was spread on the surface in the late fall and early winter of 1908, and left until a good growth of grass had started the following spring. This was then ploughed from 4 to 6 inches deep, and cultivated well on the surface, but not deeply.

Each variety of Indian corn was sown in rows 36 inches apart, and also in hills 36 inches apart each way. This was gone over with the smoothing harrow just before the plants came through the ground, and cultivated between the rows with a one-horse cultivator about once each week until the corn was from three to four feet high. The plants in the rows were thinned out to from 4 to 6 inches apart, and those in the hills to from 3 to 6 plants in a hill. The yield of each variety from both rows and hills was calculated and the weight of crop gotten from 2 rows each 66 feet long. The corn was sown June 10 and cut October 6.

The following were the results obtained:—

INDIAN CORN.—Test of Varieties.

No. of Plot	Name of Variety.	Height.	Leafiness.	When Tasselled.	In Silk.	Condition when Cut.	Weight per acre grown in Rows.		Weight per acre grown Hills.	
		In.					Tons.	Lbs.	Tons.	Lbs.
1	Angel of Midnight	82	Leafy	Sept. 16	Sept. 1	Soft glazed	22	....	19	1,050
2	Compton's Early	80	Very leafy	Aug. 13	" 1	"	20	1,250	17	100
3	Selected Leaming	84	Fairly leafy.	" 20	" 6	Early milk	20	1,250	16	1,990
4	White Cap Yellow Dent.	86	"	" 20	" 6	"	20	700	15	1,680
5	Longfellow.	80	Very leafy	" 12	" 1	Soft glazed	19	1,600	18	1,950
6	Eureka	9)	Med. leafy	" 31	....	Silking.	18	1,500	15	580
7	Champion White Pearl	90	Fairly leafy.	Sept. 6	....	"	18	1,070	14	930
8	Wood's Northern Dent	87	Very leafy	" 6	Sept. 20	Late milk	18	850	20	1,800
9	Salzer's All Gold	88	Fairly leafy.	Aug. 12	" 21	Silking.	17	1,970	15	1,570
10	Superior Fodder	81	"	Sept. 6	" 21	"	15	1,900	15	1,350
11	Mammoth Cuban	83	"	" 6	" 21	Watery	15	1,570	13	950
12	North Dakota White	76	Very leafy	Aug. 20	" 6	Soft glazed.	14	1,150	16	450
13	Early Mastodon	78	Fairly leafy.	Sept. 1	" 15	Watery	14	600	14	50
14	Davidson	64	"	Aug. 12	" 1	Late milk	14	270	12	200

INDIAN CORN SOWN AT DIFFERENT DISTANCES APART.

In this experiment, the soil and its treatment were identical with the previous test. Three varieties were used, each plot being 2 drills, each 66 feet long.

It was sown June 10, and cut October 6, with the following results:—

INDIAN CORN.—Sown at different distances apart.

Name of Variety.	Distances Apart.	Yield per Acre.	
	Inches.	Tons.	Lbs.
Longfellow	42	16	700
"	35	17	400
"	28	16	1,200
"	21	14	1,400
Champion White Pearl	42	16	60
" "	35	21	1,680
" "	28	19	00
" "	21	18	1,800
Selected Leaming	42	17	1,980
"	35	20	00
"	28	21	900
"	21	19	380

FIELD CROP OF INDIAN CORN.

One and one-half acres of Indian corn was grown in half-acre lots, the varieties used being Longfellow, Dakota White and Selected Leaming. The land was a sandy loam on which timothy hay had been grown the previous year. It was manured in the fall of 1908 with barnyard manure at the rate of 20 tons per acre, left in grass until just before sowing time, the grass ploughed down, cultivated well on the surface and sown June 11 in rows 36 inches apart. The surface was harrowed before the plants came up, and cultivated between the rows four times. The plants were thinned out with the hoe to from 4 to 6 inches apart in the rows and cut October 6 to 8.

The yields were: 'Longfellow,' 15 tons, 1,425 lbs. per acre. 'Dakota White,' 18 tons, 875 lbs. per acre. 'Selected Leaming,' 17 tons, 1,200 lbs. per acre.

FIELD CROPS OF OATS, BARLEY AND MIXED GRAIN.

Five acres of field grain, in lots of one acre each, were sown May 26.

The land was a clay loam and had been in clover hay the previous year. This field had not received any manure or other fertilizer since 1904, in which season roots were grown. Since that, alternate crops of grain and clover hay were grown.

Clover and timothy seed, at the usual rate of 10 lbs. Clover and 12 lbs. timothy per acre, were sown.

The oats in this field were considerably rusted.

The results obtained are as follows, allowing 40 lbs. per bushel for mixed grain, 48 lbs. per bushel for barley, and 34 lbs. per bushel for oats:—

Crops.	Yield per Acre.		Weight per Bush.
	Bush.	Lbs.	Lbs.
1 Acre Odessa Barley	35	..	48
1 " Sensation Oats	23	.	34
1 " Waverley "	29	17	34
1 " Pioneer "	32	24	34
1 " Mixed grain	35	20	40

FIELD CROPS OF MIXED GRAIN.

OATS, BARLEY AND PEAS.

Five acres of mixed grain were sown. The land was a clay loam in a fairly good state of fertility, the previous crop having been clover hay and a heavy crop of aftermath turned under in the fall.

This field was sown May 27 with a mixture of Waverley oats 2 bushels, Odessa barley 1 bushel, and Golden Vine peas ½ bushel, sown at the rate of 3 bushels per acre.

The grain was cut September 4, and yielded 34 bushels, 32 lbs. per acre, at 40 lbs. per bushel.

There was considerable rust on the oats of this crop.

FIELD CROPS OF MIXED GRAIN AND BLACK OATS.

Four acres of mixed grain, and one acre of Black Tartarian oats were grown in one field. This was a light sandy loam on which turnips had been grown the previous year, and for which crop, manure, at the rate of 20 tons per acre, had been applied.

This was sown June 7, and cut September 13.

The mixed grain yielded 35 bushels, 25 lbs. per acre, and the oats 48 bushels per acre.

FIELD CROPS OF OATS, BARLEY AND PEAS MIXED.

Two acres of mixed grain were grown. The land was a clay loam, largely in a poor state of fertility, having been used for a series of plots for fertilizer experiments from 1899 to 1903, during which period some plots had commercial fertilizers, some barn-yard manure, and some were left unfertilized. The following five years, 1904 to 1908, this field was cropped continuously with grain without any fertilizer of any kind being applied.

No fertilizer was used this season, 1909.

The yield from this field was 44 bushels.

EXPERIMENTS WITH TURNIPS.

Twelve varieties of turnips were sown in uniform test plots on June 4, and a duplicate set on June 18. The land was a clay loam on which timothy hay had been grown the previous year. This was ploughed in the fall of 1908, well cultivated in the spring, and barn-yard manure spread on the surface at the rate of 20 tons per acre, which was ploughed under with a gang plough, and the land again thoroughly cultivated. Complete fertilizer (made up in the proportion of superphosphate, 1½ lbs.; bone meal, 1½ lbs.; nitrate of soda, 1 lb.; muriate of potash, 1 lb.), mixed together, and sown at the rate of 300 lbs. per acre, was then spread on the surface and harrowed in with the smoothing harrow.

The seed was sown in rows 24 inches apart, and the plants thinned out to one foot apart in the row. The crop was cultivated between the rows with a one-horse cultivator, on an average every ten days up to about July 15, and gone through with the hoe once besides thinning. The yield was calculated from the weight gathered from two rows, each 66 feet long.

This crop was pulled November 2, with the following results:—

No. of Plot.	Name of Variety.	Yield per Acre.							
		1st Plot.				2nd Plot.			
		Tons.	lbs.	Bush.	lbs.	Tons.	lbs.	Bush.	lbs.
1	Magnum Bonum	39	1,200	1,320	..	26	1,295	888	15
2	Kangaroo	36	105	1,201	45	28	1,255	954	15
3	Carter's Elephant	35	1,280	1,188	..	27	780	913	..
4	Halewood's Bronze Top	35	950	1,182	30	25	655	844	15
5	Hall's Westbury	35	125	1,168	45	25	1,150	852	30
6	Jumbo	34	475	1,141	15	29	1,895	998	15
7	Mammoth Clyde	32	350	1,072	30	30	225	1,003	45
8	Hartley's Bronze	31	1,525	1,058	45	28	1,420	957	..
9	Good Luck	31	1,030	1,050	30	28	595	943	15
10	Bangholm Selected	30	1,875	1,031	15	31	700	1,045	..
11	Skirving's	30	225	1,003	45	23	1,025	783	45
12	Perfection Swede	28	925	948	45	28	100	935	..

FIELD CROP OF TURNIPS.

Eight acres of turnips were grown in lots of one acre each. The land varied from a clay to a light sandy loam, some of each being included in each plot. The previous crop had been hay. The land was ploughed in the fall of 1908, well worked up in the spring, and barn-yard manure at the rate of 20 tons per acre spread on the surface and ploughed under lightly with the gang plough. It was again thoroughly cultivated, and the rows run up 24 inches apart, as far as possible from 24 to 48 hours ahead of seeding time. To one-half of one acre was added complete fertilizer (superphosphate, 1½ lbs.; bone meal, 1½ lbs.; nitrate of soda, 1 lb.; muriate of potash, 1 lb.), at the rate of 600 lbs. per acre, and to the other half at the rate of 300 lbs. per acre, and to one-half of each of the other seven acres at the rate of 300 lbs per acre; the other half of each of the seven acres receiving the barn-yard manure only.

The weather was cold and dry for a long time after sowing, with the result that the seed started very poorly, not more than possibly one-tenth of the seed germinated, and it looked very much as if all would have to be resown. A good fall of rain was experienced on the night of June 28. Shortly after this, on examining closely, it could be seen that the remainder of the seed was beginning to germinate. It came

up nicely in about 4 or 5 days, being all of 3 weeks after sowing. From this on, the crop made very satisfactory growth.

Sown June 12 to 17 and harvested November 6 to 18, with the following results:—

FIELD CROP OF TURNIPS.

Name of Variety, How Fertilized, Size of Plot.		Yield per Acre.		Yield per Acre.	
		Tons.	Lbs.	Bush.	Lbs.
Hartley's Bronze Top—(Pulled November 6).					
½ acre. Manure and fertilizer, 600 lbs. per acre		28	1,970	966	10
" " " 300 "		27	1,890	931	30
Cost per acre of extra fertilizer, 300 lbs. at $32 per ton	$ 4 80				
Value per acre of increased crop from extra fertilizer, $34\frac{4}{5}$ bush. at 6c. per bushel	2 08				
Loss per acre	$ 2 72				
Kangaroo—(Pulled November 8).					
½ acre. Manure and fertilizer, 300 lbs. per acre		27	900	915	..
" " only		24	1,510	825	10
Cost per acre of 300 lbs. fertilizer at $32 per ton	$ 4.80				
Value per acre of crop over manure only, $89\frac{3}{5}$ bush. at 6c. per bushel	5 39				
Gain per acre	59				
Magnum Bonum—(Pulled November 9).					
½ acre. Manure and fertilizer, 300 lbs. per acre		28	00	933	20
" " only		27	460	907	40
Cost per acre of 300 lbs. fertilizer at $32 per ton	$ 4 80				
Value per acre of crop over manure only, $25\frac{4}{5}$ bush. at 6c. per bushel	1 54				
Loss per acre	$ 3 26				
Sutton's Champion—(Pulled November 11).					
½ acre. Manure and fertilizer, 300 lbs. per acre		23	110	768	30
" " only		24	380	806	20
Cost per acre of 300 lbs. fertilizer at $32 per ton	$ 4.80				
Value per acre of loss in crop over manure only, $37\frac{3}{5}$ bush. at 6c. per bushel	2 27				
Loss per acre	$ 7 07				
Canadian Gem—(Pulled November 13).					
½ acre. Manure and fertilizer, 300 lbs. per acre		26	1,780	896	20
" " only		26	150	869	10
Cost per acre of 300 lbs. fertilizer at $32 per ton	$ 4 80				
Value per acre of gain in crop over manure only, $27\frac{1}{5}$ bush. at 6c. per bushel	1 63				
Loss per acre	$ 3 17				
Rennie's Prize—(Pulled November 15).					
½ acre. Manure and fertilizer, 300 lbs. per acre		26	210	870	10
" " only		23	990	783	10
Cost per acre of 300 lbs. fertilizer at $32 per ton	$ 4 80				
Value per acre of gain in crop over mauure only, 87 bush. at 6c. per bushel	5 22				
Gain per acre	0 42				

FIELD CROP OF TURNIPS—*Concluded.*

Name of Variety, How Fertilized, Size of Plot.		Yield per Acre.		Yield per Acre.	
		Tons.	Lbs.	Tons.	Lbs.
Elephant—(Pulled November 16).					
½ acre. Manure and fertilizer, 300 lbs. per acre.		25	1,120	852	..
" " only		24	600	810	..
Cost per acre of 300 lbs. fertilizer at $32 per ton	$ 4 80				
Value per acre of gain in crop over manure only, 42 bush, at 6c. per bushel	2 52				
Loss per acre	2 28				
Mixed Varieties—(Pulled November 18).					
½ acre. Manure and fertilizer, 300 lbs. per acre		24	200	803	20
" " only		23	1,140	785	40
Cost per acre of 300 lbs. fertilizer at $32 per ton	$ 4 80				
Value per acre of gain in crop over manure only, 17⅔ bush. at 6c. per bushel	1 06				
Loss per acre	$ 3 74				

FIELD CROP OF TURNIPS II.

One acre of turnips was grown in 4 lots of ¼ acre each. The land was a light clay loam, the previous crop having been timothy hay. This was ploughed in the fall of 1908 and cultivated well in the spring, after which barn-yard manure at the rate of 20 tons per acre was spread on the surface and ploughed under with the gang plough. This was again thoroughly cultivated and run into rows 24 inches apart. On one half of each lot, complete fertilizer (superphosphate 1½ lbs., bone meal 1½ lbs., nitrate of soda 1 lb., and muriate of potash 1 lb.) was added at the rate of 300 lbs. per acre.

The plants were thinned out to one foot apart in the rows and received one other hoeing besides. They were cultivated with a one-horse cultivator between the rows 4 times during the season. The seed was sown June 11 and the roots were pulled November 2 and 3.

FIELD CROPS OF TURNIPS.

Name of Variety, How Fertilized, Size of Plot.		Yield per Acre.		Yield per Acre.	
		Tons.	Lbs.	Bush.	Lbs.
Improved Elephant—(Pulled November 2.)					
⅛ acre. Manure and fertilizer, 300 lbs per acre		30	320	1,005	20
⅛ " " only		27	1,360	922	40
Cost per acre of 300 lbs, fertilizer at $32 per ton	$ 4 80				
Value per acre of gain in crop over manure only, 82⅔ bush. at 6c. per bushel	4 96				
Gain per acre	.16				
Magnum Bonum—(Pulled November 2.)					
⅛ acre. Manure and Fertilizer, at 300 lbs. per acre		28	160	936	..
⅛ " " only		28	200	936	40
Cost per acre of 300 lbs. fertilizer at $32 per ton	4 80				
Value per acre of loss in crop over manure only, 40 lbs. at 6c. per bushel	0 04				
Loss per acre	4 84				
Hartley's Bronze Top—(Pulled November 3).					
⅛ acre. Manure and fertilizer, 300 lbs. per acre		29	1,200	986	40
⅛ " " only		29	360	972	40
Cost per acre of 300 lbs. fertilizer at $32 per ton	4 80				
Value per acre of gain in crop over manure only 14 bush. at 6c. per bushel	0 84				
Loss per acre	3 96				
Kangaroo—(Pulled November 3).					
⅛ acre. Mauure and fertilizer, 300 lbs. per acre		26	360	872	40
⅛ " " only		24	960	816	.
Cost per acre of 300 lbs. fertilizer at $32 per ton	4 80				
Value per acre of gain in crop over manure only, 56⅔ bush. at 6c. per bushel	3 40				
Loss per acre	1 40				

EXPERIMENTS WITH MANGELS.

Ten varieties of mangels were sown in uniform test plots on June 3 and a duplicate set of each on June 17. The land was a clay loam on which timothy hay had been grown the previous year. This was ploughed in the fall of 1908, well cultivated in the spring, and barn-yard manure spread on the surface at the rate of 20 tons per acre, ploughed under with a gang plough, and the land again thoroughly cultivated. Complete fertilizer made up of superphosphate 1½ lbs., bone meal 1½ lbs., nitrate of soda 1 lb. and muriate of potash 1 lb. mixed together and sown at the rate of 300 lbs. per acre was then spread on the surface and harrowed in with the smoothing harrow.

The land was run into rows 24 inches apart and sown with the Planet, Jr., drill in bunches 1 foot apart with from 3 to 6 seeds in each bunch. When the plants were from 2 to 4 inches high they were thinned out, leaving the best plant in each spot, and cultivated between the rows with a one-horse cultivator on an average every ten days up to about July 15. They were gone through twice with the hoe besides thinning.

This crop was pulled October 27 and the yield calculated in each case from the weight of roots gathered from two rows, each 66 feet long.

The following are the results obtained:—

MANGELS—Test of Varieties.

No. of Plot.	Name of Variety.	Yield per Acre. 1st Plot. Tons.	Lbs.	Bush.	Lbs.	2nd Plot. Tons.	Lbs.	Bush.	Lbs.
1	Selected Yellow Globe	42	975	1,416	15	29	80	968	..
2	Yellow Intermediate	42	150	1,402	30	28	430	940	30
3	Giant Yellow Globe	41	1,655	1,394	15	28	100	935	..
4	Mammoth Red Intermediate	41	1,325	1,388	45	28	1,255	954	15
5	Half Long Sugar White	40	850	1,347	30	33	825	1,113	45
6	Giant Yellow Intermediate	38	1,550	1,292	30	27	1,605	926	45
7	Crimson Champion	37	1,075	1,251	15	29	1,400	990	..
8	Gate Post	33	825	1,113	45	27	780	913	..
9	Prize Mammoth Long Red	32	1,175	1,086	15	23	200	770	..
10	Perfection Mammoth Long Red.	30	1,875	1,031	15	22	1,705	761	45

FIELD CROPS OF MANGELS.

One acre of mangels was grown in 4 lots of $\frac{1}{4}$ acre each. The land was a light clay loam, the previous crop having been timothy hay. This was ploughed in the fall of 1908 and cultivated well in the spring, after which barn-yard manure at the rate of 20 tons per acre was spread on the surface and ploughed under with the gang plough. The land was again thoroughly cultivated and run into rows 24 inches apart. On one-half of each lot complete fertilizer (superphosphate $1\frac{1}{2}$ lbs., bone meal $1\frac{1}{2}$ lbs., nitrate of soda 1 lb., muriate of potash 1 lb.) mixed together, was added at the rate of 300 lbs. per acre.

The seed was sown with the Planet Junior seed drill in bunches one foot apart, with from 3 to 6 seeds in each bunch. When the plants were from 2 to 4 inches high, they were thinned out, leaving the best plant in each spot, cultivated between the rows with a one-horse cultivator about 4 times during the season, receiving one hoeing besides. They were sown June 8 and pulled October 28 to November 1.

FIELD CROPS OF MANGELS.

Name of Variety, How Fertilized, Size of Plot.		Yield per Acre.		Yield per Acre.	
		Tons.	Lbs.	Bush.	Lbs.
Mammoth Long Red—(Pulled October 28).					
½ acre. Manure and fertilizer, 300 lbs. per acre		23	600	776	40
" " only		22	1,200	753	20
Cost per acre of 300 lbs. fertilizer at $32 per ton	$ 4 80				
Value per acre in crop over manure only, $23\frac{2}{6}$ bush. at 6c. per bushel	1 40				
Loss per acre	$ 3 40				
Yellow Half-Long—(Pulled October 28).					
½ acre. Manure and fertilizer, 300 lbs. per acre		25	120	835	20
" " only		23	1,040	784	..
Cost per acre of 300 lbs. fertilizer at $32 per ton	$ 4 80				
Value per acre in crop over manure only, $51\frac{2}{6}$ bush. at 6c. per bushel	3 08				
Loss per acre	$ 1 72				
Yellow Globe—(Pulled November 1).					
½ acre. Manure and fertilizer, 300 lbs. per acre		27	480	908	..
" " only		25	1,960	866	.
Cost per acre of 300 lbs. fertilizer at $32 per ton	$ 4 80				
Value per acre in crop over manure only, 42 bush. at 6c. per bushel	2 52				
Loss per acre	$ 2 28				
Golden Tankard—(Pulled November 1).					
½ acre. Manure and fertilizer, 300 lbs. per acre		22	1,280	754	40
" " only		21	1,800	730	..
Cost per acre of 300 lbs. fertilizer at $32 per ton	$ 4 80				
Value per acre in crop over manure only, $24\frac{4}{6}$ bush. at 6c. per bushel	1 48				
Loss per acre	$ 3 32				

EXPERIMENTS WITH CARROTS.

Five varieties of carrots were sown in uniform test plots on June 3 and a duplicate set on June 17. The land was a clay loam on which timothy hay had been grown the previous year. This was ploughed in the fall of 1908, well cultivated in the spring, and barn-yard manure spread on the surface at the rate of 20 tons per acre. This was ploughed under with a gang plough and the land again thoroughly cultivated. Complete fertilizer (made up of superphosphate, $1\frac{1}{2}$ lbs.; bone meal, $1\frac{1}{2}$ lbs.; nitrate of soda, 1 lb.; muriate of potash, 1 lb.) mixed together and sown at the rate of 300 lbs. per acre was then spread on the surface and harrowed in with the smoothing harrow. The seed was sown in rows 24 inches apart, and the plants thinned out by hand to about 3 inches apart in the rows.

The crop was pulled November 4 and the yield calculated from the weight obtained from 2 rows each 66 feet long.

The following are the results:—

CARROTS.—Test of Varieties.

No. of Plot.	Name of Variety.	Yield per Acre							
		1st Plot.				2nd Plot.			
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.
1	Ontario Champion	21	405	706	45	18	1,125	618	45
2	White Belgian	21	240	704	..	23	530	775	30
3	Half Long Chantenay	21	75	701	15	19	775	646	15
4	Improved Short White	20	95	668	15	15	1,350	522	30
5	Mammoth White Intermediate	17	1,475	591	15	16	505	541	45

EXPERIMENTS WITH SUGAR BEETS.

Three varieties of sugar beets were sown in uniform test plots on June 3, and a duplicate set on June 17. The land was a clay loam on which timothy hay had been grown the previous year. This was ploughed in the fall of 1908, well cultivated in the spring and barn-yard manure spread on the surface at the rate of 20 tons per acre and ploughed under with a gang plough, and again thoroughly cultivated. Complete fertilizer, (made up of superphosphate, 1½ lbs.; bone meal, 1½ lbs.; nitrate of soda, 1 lb., and muriate of potash, 1 lb.) were mixed together and sown at the rate of 300 lbs. per acre and then harrowed in with the smoothing harrow.

The land was run into rows 24 inches apart and the seed was sown with the Planet Junior drill seeder in bunches 1 foot apart, with from 3 to 6 seeds in each bunch. When the plants were from 2 to 4 inches high, they were thinned out leaving the best plants in each spot, and cultivated between the rows with a one-horse cultivator on an average every ten days up to the middle of July, and gone through twice with the hoe besides the thinning.

This crop was pulled October 27 and the yield calculated in each case from the weight of roots gathered from two rows, each 66 feet long.

The following are the results obtained:—

SUGAR BEETS—Test of Varieties.

No. of Plot	Name of Variety.	Yield per Acre, 1st Plot.		Yield per Acre, 1st Plot.		Yield per Acre, 2nd Plot.		Yield per Acre, 2nd Plot.		Sugar in Juice.	Solids in Juice.	Co-efficient of Purity.
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.			
1	French Very Rich	14	875	481	15	12	1,410	423	30	16·05	17·97	89·3
2	Klein Wanzleben	13	1,225	453	45	11	605	376	45	16·63	18·67	89 0
3	Vilmorin's Improved	12	1,575	426	15	10	1,945	365	45	17 52	19·83	88·3

EXPERIMENTS WITH POTATOES.

Nineteen varieties of potatoes were planted in uniform test plots. The ground was a clay loam in good condition, having grown a heavy crop of clover hay the previous year. A heavy crop of aftermath was ploughed under in the early fall of 1908,

and cultivated once. The land was thoroughly worked up in the spring of 1909, ploughed crosswise and again well worked up. Complete fertilizer (superphosphate, 1½ lbs.; bone meal, 1½ lbs.; nitrate of soda, 1 lb.; muriate of potash, 1 lb.) at the rate of 400 lbs. per acre was applied by scattering in the open rows before planting. No barn-yard manure was used for this crop. The rows were 30 inches apart, and the sets (having at least three good eyes per set) were planted one foot apart in the rows. The drills were harrowed down twice, and rowed up again before the plants came up. The vines were sprayed with Bordeaux mixture three times, with Paris green added to kill the potato beetle. Shortly before digging time, an extremely wet spell of weather was experienced, followed immediately by unusual heat of about one week's duration. This, we believe, was the cause of an unusual amount of rotten and unmarketable potatoes.

There was no blight or scab.

The potatoes were planted June 9 and dug October 14 and 15.

The yield per acre has been calculated from the crop obtained from two rows, each 66 feet long.

The following are the yields obtained:—

Potatoes—Test of Varieties.

No. of Plot.	Name of Variety.	Total Yield per Acre.		Yield per Acre of Sound.		Yield per Acre of Rotten.		Yield per Acre of Marketable.		Yield per Acre of Unmarketable.		Form and Colour.
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	
1	Everett	556	36	424	36	132	..	374	..	182	36	Round, white.
2	Ashleaf Kidney	506	..	374	..	132	..	341	..	165	..	" "
3	Irish Cobbler	475	12	292	36	182	36	235	24	239	48	" "
4	Vick's Extra Early	464	12	420	12	44	..	380	36	83	36	Long "
5	Carman No. 1	462	..	305	48	156	12	343	..	220	..	Round "
6	State of Maine	457	36	343	12	114	24	308	..	149	36	" "
7	Money Maker	448	48	360	48	88		292	36	156	12	" "
8	Morgan Seedling	442	12	396	36	72	36	341	..	101	12	Long "
9	Gold Coin	435	36	308	..	127	36	270	36	165	..	Round "
10	Reeve's Rose	420	12	323	24	96	48	268	24	151	48	Long, pink.
11	Rochester Rose	400	24	363	..	37	24	323	24	77	..	Long round, pink.
12	Dooley	387	12	341	..	46	12	310	12	77	..	Round, white.
13	Holborn Abundance	363	..	279	24	83	36	235	24	127	36	" "
14	Late Puritan	360	48	206	48	154	..	173	48	188	..	Long "
15	Dreer's Standard	338	48	283	48	55	..	239	48	99	..	Round "
16	Empire State	336	36	275	..	61	36	248	36	88	..	Long "
17	American Wonder	334	24	235	24	99	..	213	24	121	..	Long round, white.
18	Dalmeny Beauty	321	12	239	48	81	24	220	..	101	12	Oval, white.
19	Uncle Gideon's Quick Lunch	231	..	189	12	41	48	165	..	66	..	Round, pink.

CLOVER EXPERIMENTS.

Experiments were again conducted to determine the gains, if any, from growing clover with grain crops for the purpose of ploughing under the growth of clover made during the previous season. This was a sandy soil in a fairly good state of fertility, having grown roots in 1907, for which crop barn-yard manure had been applied. The land was sown with mixed grain in 1908.

For the past four seasons this experiment had been conducted on the same field, and, for various reasons, a change of place was considered necessary; consequently,

one-half of this field of mixed grain (1908) was seeded with clover and the other half left unseeded, with a view to using it for this experiment in 1909.

The following results were obtained:—

CLOVER EXPERIMENTS.

Number.	Name of Variety and how Seeded.	Yield per Acre.	
	Early Riga Wheat—Sown May 26, cut August 30.	Bush.	Lbs.
1	Without clover, 1908	20	20
2	With clover, 1908	22	0
3	Without clover, 1908	21	40
4	With clover, 1908	23	20
	Odessa Barley—Sown May 26, cut August 23.		
1	Without clover, 1908	34	28
2	With clover, 1908	36	12
3	Without clover, 1908	35	40
4	With clover, 1908	36	42
	Sensation Oats—Sown May 26, cut Aug. 31.		
1	Without clover, 1908	42	32
2	With clover, 1908	45	10
3	Without clover, 1908	44	04
4	With clover, 1908	43	18

EXPERIMENTS WITH ALFALFA.

Experiments with alfalfa were again conducted, five varieties being used, namely: Montana alfalfa, No. 23454; Grimm's alfalfa, No. 25102; Canadian alfalfa, No. 24836; Sand Lucerne, No. 23394; and *Medicago falcata*, No. 24452.

The land was a heavy clay loam, well drained, on which potatoes had been grown the previous year, and was thoroughly cultivated three times before seeding. Lime at the rate of three casks per acre was spread on the surface of the soil before sowing, and harrowed in.

The seed was all treated with nitro-culture and sown June 5.

No nurse crop was used.

With the exception of *Medicago falcata*, No. 24452, of which the very little that grew was very sickly and made extremely poor growth, all made a good, healthy stand.

This was cut twice during the season, the first time when the plants were about 8 inches high. The cuttings were left on the ground for a mulch, and at the date of writing, March 31, would appear to have come through the winter better than usual, which, however, has never been satisfactory.

FLAX.

One half acre of flax was grown on land that was a rather heavy clay loam on which turnips had been grown the previous year, for which crop barn-yard manure at the rate of 20 tons per acre had been supplied.

The seed was sown June 5 at the rate of 60 lbs. per acre, and the crop was cut August 28, having taken 84 days to mature. The average length of plants was 26 inches, and the yield of seed was 380 lbs., or at the rate of 11 bushels, 32 lbs. per acre

EXPERIMENTS WITH RUN-OUT LAND.

The experiment to determine the practicability of restoring run-out land, where a limited amount of manure is available, was continued this season. This was commenced in the season of 1906 on a field of 8 acres of heavy clay with some little loam, badly run-out and particularly deficient in humus. This field had grown grain, and had been sown to grass sixteen years previous, since when it had been lying in pasture, and producing extremely little after the first three years. The field was made into four plots of 2 acres each.

With a view to making each plot as nearly equal in fertility as possible, the field was divided into 8 parts of 1 acre each, and numbered 1 to 8. Nos. 1 and 8 being designated plot 1, (2 acres); Nos. 2 and 7, plot 2 (2 acres); Nos. 3 and 6, plot 3 (2 acres); and Nos. 4 and 5, plot 4 (2 acres).

On plot 1 no fertilizer was used; on plot 2, 300 lbs complete fertilizer per acre was used. On plot 3, 600 lbs. complete fertilizer per acre was used, and on plot 4, 10 one-horse cart-loads of barn-yard manure was used.

In the season of 1906, this field was sown with peas, oats and vetches, mixed together and sown at the rate of 3 bushels per acre. They were allowed to grow until about August 1, when the entire crop was ploughed under. This was repeated in 1907. In 1908 it was sown with Waverley oats, Odessa barley, and Prussian Blue peas, mixed together and sown at the rate of 3 bushels per care, together with clover and timothy at the rate of 10 lbs. clover and 12 lbs. timothy seed per acre.

The following tables will show the yields of grain obtained in 1908, and also that of clover hay obtained in 1909:—

YIELD OF GRAIN, 1908.

No. of Plot.	How Fertilized.	Yield per Plot (2 acres).		Weight per Bushel.
		Bush.	Lbs.	Lbs.
1	No fertilizer used	61	04	40
2	300 lbs. fertilizer per acre	78	08	40
3	600 lbs. " "	82	05	40
4	10 one-horse cart-loads manure	95	04	40

YIELD OF HAY, 1909.

No. of Plot.	How Fertilized.	Yield per Plot (2 acres.)	
		Tons.	Lbs.
1	No fertilizer used	2	190
2	300 lbs. fertilizer per acre	2	925
3	600 lbs. " "	2	1,275
4	10 one-horse cart-loads manure	3	325

EXPERIMENTS WITH FERTILIZERS ON MARSH.

Further experiments with lime and commercial fertilizers on marsh or dyke lands were commenced this year as usual along the same lines as last year, but, owing to the breaking of the dykes in September and the overflowing of the dyke lands, no record was obtainable.

HAY CROP.

The hay crop was fairly well up to the average on upland, but not by any means up to the average on marsh, except where it was the first crop.

Twenty-six acres on upland yielded 57 tons, 980 lbs.

Forty-two acres on marsh yielded 68 tons, 175 lbs.

SUMMARY OF CROPS GROWN, EXCLUSIVE OF UNIFORM TEST PLOTS OF GRAIN AND POTATOES.

HAY.

	Tons.	Lbs.
Upland hay	57	980
Marsh hay	68	175
	125	1,155

GRAIN.

	Bush.	Lbs.	Lbs.
Mixed grain	396	20	15,860
Oats	364	18	12,394
Barley	65	..	3,120
Buckwheat	203	..	9,744
			41,118

TURNIPS.

	Bush.	Lbs.	Tons.	Lbs.
Turnips (field crop)	7,792	50	233	1,570
Turnips (test plots)	254	10	7	1,250
	8,047	..	241	820

MANGELS.

	Bush.	Lbs.	Tons.	Lbs.
Mangels (field crop)	801	..	24	60
Mangles (test plots)	166	40	5	..
	967	40	29	60

CORN.

	Tons.	Lbs.
Corn (field crop)	25	1,750
Corn (test plots)	10	1,620
	36	1,370

FRUIT AND VEGETABLE CROPS.

APPLES.

The apple crop was very much below the average this year, and the quality of the fruit inferior to that grown the previous year, possibly owing to the lack of sunshine not allowing the fruit to ripen well.

Strawberries.

The strawberry plants came through the winter very well, but, owing to a particularly dry season up to the end of June, the vines did not promise a large crop. However, some showers coming at the latter end of June and the beginning of July improved the fruit and a fair crop of good-sized berries was picked. The earliest picking was July 7, three days later than in 1909. The size of the plot of each variety was 16½ x 5 feet.

Following are the yields from 20 of the most productive varieties:—

Strawberries—Test of Varieties.

Variety.	Dates when Picked.					Yield per Plot.	Yield per Acre.
	July 7.	July 10.	July 14.	July 16.	July 26.		
	Qts.	Qts.	Qts.	Qts.	Qts.	Qts.	Qts.
Gandy	2	1	7	11	10	31	16,368
Barton's	1	3	7	12	6	29	15,312
Clyde	½	4	14	6	4	28½	15,048
Swindle	2	2	9	8	7	28	14,784
G. H. Coughell	....	3	8	8	7	26	13,728
Pearl	1	1	10	6	7	25	13,200
Bisel	1	....	8	10	5	24	12,672
Minute Man	1	2	7	6	7	23	12,144
Maggie	2	4	7	4	6	23	12,144
Parker Earle	1	2	9	6	4	22	11,616
Pocomoke	1	....	6	10	5	22	11,616
John Little	3	4	7	5	3	22	11,616
Princess	2	....	9	7	3	21	11,088
Beverley	1½	2	7	7	3	20½	10,824
Enhance	....	3	4	8	5	20	10,560
Afton	....	....	8	5	7	20	10,560
Early Beauty	4	4	6	3	1½	18½	9,768
Capt. Jack	1½	3	4	8	1	17½	9,240
Jas. Vick	....	4	5	5	3	17	8,976
Seneca Queen	....	4	6½	4	2	16	8,448

GARDEN CROPS.

PEAS.

Experiments were again conducted with six of the leading varieties of garden peas.

The seed was sown on May 28, in plots each 66 feet long by 2½ feet wide, 2 inches apart in the rows, and about 2 inches deep. As each variety became ready for use, the date was recorded, and the yield of green pods from the several pickings entered.

The yields were as follows:—

GARDEN PEAS—Test of Varieties.

Variety.	Date of Picking and Yields.				Total Yield from Plots.	
	August 8.		August 15.			
	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.
Thomas Laxton	12	8	6	8	19	..
Gradus	12	8	4	4	16	12
American Wonder	13	..	2	4	15	4
Telephone	10	8	3	8	14	..
Stratagem	10	8	5	8	14	..
Prosperity	8	..	3	..	11	..

GARDEN BEANS.

Six varieties of garden beans were grown this year. The seed was planted in rows 33 feet long, being dropped 2 inches apart in the rows. A duplicate plot of each variety was planted to ripen for seed.

Owing to the extremely wet season, the beans ripened very unevenly and were much rusted, consequently no record was kept of the ripened seed.

The following yields of green beans were gathered, when fit for market:—

GARDEN BEANS—Test of Varieties.

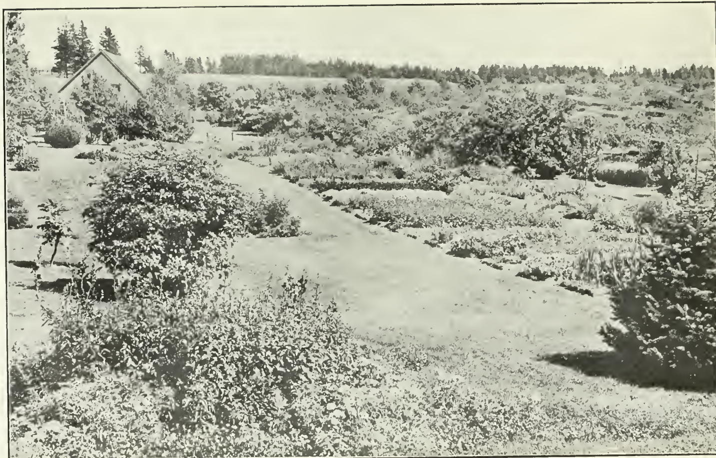
Variety.	Date of Picking and Yields.						Total Yield from Plots.	
	Aug. 5.		Aug. 16.		Aug. 23.			
	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.
Golden Skinless	14	0	4	0	3	8	21	8
Fame of Vitry	12	8	5	8	2	0	20	0
Dwarf Extra Early	12	8	5	8	1	8	19	8
Emperor of Russia	10	8	4	8	2	0	17	0
Dwarf Matchless	8	0	6	0	3	0	17	0
" Wax	8	8	4	0	3	0	15	8

TOMATOES.

Ten varieties were planted. These were started in hot-beds on March 27, and kept in a cold frame from April 30 to June 16, when eight plants of each variety were planted in the field, 4 feet apart each way.

About the time the fruit formed, they were struck with blight, six of the ten varieties so much so as to be almost ruined, no record being kept of them.

The following is a list of all varieties sown, together with the yields of the remaining four:—



Flower Beds and part of Orchard. Experimental Farm, Nappan, N.S.

TOMATOES—Test of Varieties.

Variety.	Ripe Fruit.	Green Fruit.	Yield per plot.
	Lbs.	Lbs.	Lbs.
Chalk's Early Jewel	126	224	350
Golden Queen	34	222	256
Atlantic Prize	37	150	189
Coreless	.....	60	60
June Pink	Badly.	Blighted.	
Matchless	"	"	
Livingston Beauty	"	"	
Spark's Earliana (Ottawa)	"	"	
" " (Burpee)	"	"	
Ponderosa	"	"	

HORSES.

The horses on the Farm are kept exclusively as work animals, no experiment of any kind being carried on. No change has been made in the number during the past year, which is eight, consisting of three teams of draught horses, one express horse, and one driver. All are in good condition.

CATTLE.

STEER-FEEDING EXPERIMENT.

With the exception of one cow kept for milk purposes, all the cattle on the Farm consist of grade steers, bought in the fall for fattening purposes, with the intention of selling again in the spring. The number fed this year was 64 head. They were bought in October and the early part of November, dehorned, and put under experiment December 1. The weight credited to them at the beginning of the experiment was the weight found at 9 a.m. without their having received any food since 7 p.m. the previous evening. For the first thirty days, beginning November 15, they were fed large quantities of roots and clover hay, the object being the getting of them into proper condition to make the best use of meal feeds. By December 15, they were being fed 60 lbs. of turnips per day per steer. From December 15 to January 15, 1 lb. meal per day per steer was added. From this time to the time of writing the meal feed has been increased 1 lb. per day per steer each month, while the roots have been decreased 10 lbs. per day per steer each month.

A very satisfactory sale for May delivery has already been made.

	Lbs.
Total live weight of 64 steers, December 1, 1909	64,410
Total live weight of 64 steers, March 31, 1910	77,675
Increase	13,265
Average daily gain per steer	1·72

COMPLETION OF STEER FEEDING EXPERIMENT OF 1909, FINISHED SINCE LAST REPORT.

On making my report to March 31, 1909, the 53 steers under experiment were still on hand. The following is a continuation and conclusion of said experiment:—

EXPERIMENT WITH STEERS, 1909, UNFINISHED IN LAST REPORT.

	Lbs.
Total live weight of 53 steers, Nov. 16, 1908..	56,400
Total live weight or 53 steers, March 31, 1909..	66,420
Increase to March 31, 1909..	10,020
Total live weight of 53 steers, April 30, 1909..	69,205
Increase to April 30, 1909, total..	12,805

FINANCIAL RESULTS.

Original weight of 53 steers, 56,400 lbs. at 4·32 cts. per lb.	$2,436 93
Weight at finish of 53 steers, 69,205 lbs. at 5·65 cts. per lb.	3,910 08
Gross profit..	1,473 15
Cost of feed for lot 165 days..	1,268 03
Net profit..	205 12

Daily rate of gain per steer, 1·46 lbs.
Cost of 1 lb. gain per steer, 9·90 cts.
Cost of feed per day per steer, 14·5 cts.
Profit per steer, $3.87.

SHEEP.

Twenty-five sheep are now on hand, representing Shropshires, Leicesters, and their grades as follows:—

13 Shropshires.
6 Leicesters.
6 Grades.

Owing to the small area of pasture available, and the difficulty of increasing it without a great deal of fencing, and rearranging of methods, it has not seemed advisable to increase the flock to any material extent. Only the desirable ewe lambs have been kept, while about an equal number of the old ewes have been disposed of. No lambs were dropped this season by the Leicester ewes.

POULTRY.

Four breeds of poultry are now kept on the Farm, *i.e.,* Barred Plymouth Rocks, White Leghorns, White Wyandottes and Buff Orpingtons.

The pens were made up as follows:—

	Cocks.	Hens.
Barred Plymouth Rocks..	1	9
White Leghorns..	1	8
White Wyandottes..	1	3
Buff Orpingtons..	1	4

The number of eggs laid by the different breeds during the year is as follows:—

	Eggs.	Average.
8 B. P. Rocks..	736	92
4 W. Wyandottes..	320	80
10 W. Leghorns..	900	90
6 Blk. Minorcas..	400	66⅔

The strain of Minorcas on the Farm was not considered a good one and the birds were exchanged for the Buff Orpingtons mentioned above.

BEES.

As mentioned in my last report (1909), an experiment to determine the effect, if any, that wintering bees on the coarser native fall honey, as against sugar syrup, would have on them during the spring, was carried on. Two sets of three colonies each were used. The first set had their sealed stores left them undisturbed, the second set were fed sugar syrup, made from the best granulated sugar, two parts sugar to one part water by weight. To make this syrup, the water was first boiled and the sugar then stirred in. The Miller feeder was used in a shallow extracting super.

After March, the clusters broke and the bees were moved to their summer stands in April. A good deal of dysentery was found in those hives which had wintered on the native stores, and but a very little in one hive only that was wintered on sugar syrup. The experiment so far had been very much in favour of the syrup feeding.

During April and May we had much cold and wet weather, the alternating fine and damp days having an injurious effect, causing great loss from spring dwindling. The loss from this cause was quite as great in those hives where syrup was fed as where honey was used during the winter, leaving both lots in poor shape to take advantage of the clover season, which was very short here. The latter end of June and the month of July was ideal growing weather, with plenty of heat, but also with plenty of rain, indeed rain fell on half the days in the latter month, much hindering the gathering of clover honey. During September, when we get our flow from the fall flowers, the weather again was cold and wet. The result was that very little honey was extracted.

Nine colonies were put into the cellar in strong shape on December 14, 1909. The covers and quilts were removed from the hives and three empty grain bags put over each and the body raised from the bottom board at the entrance with a 2-inch block. This method of caring for the bees during the winter has been so successful, that it is being generally adopted in Nova Scotia, the raised entrance and the dry open bags on top allowing such good ventilation, that we never see any appearance of mildew on the frames.

At the date of writing, March 31, 1910, all colonies are quiet and clustering on the frames.

GRAIN AND POTATO DISTRIBUTION.

Some of the most promising varieties of grain and potatoes were again distributed this year to farmers who made application.

The following number of three pound packages were sent out for trial:—

Potatoes	252
Oats	350
Barley	57
Wheat	46
Buckwheat	25
Total number of samples sent out	730

AGRICULTURAL MEETINGS ATTENDED.

During the year I attended and delivered addresses at the following meetings:—

Scotsburn, Pictou Co., N.S.
River John, Pictou Co., N.S.
Sussex Dairy School, Kings Co., N.S.
Antigonish, Antigonish Co., N.S.
Miscouche, P.E.I.

Lot 16, P.E.I.
Collingwood Corner, Cumberland Co., N.S.
Maccan, Cumberland Co., N.S.
Summerside, P.E.I.
North Bedeque, P.E.I.
Freetown, P.E.I.
Truro Agricultural College Short Course, Truro, N.S.
Newville, Cumberland Co., N.S.
Halfway River, Cumberland Co., N.S.
Millvale, Cumberland Co., N.S.
New Glasgow, Pictou Co., N.S.
Fredericton, York Co., N.B.
Chatham, Northumberland Co., N.B.
Nappan, Cumberland Co., N.S.
Diligent River, Cumberland Co., N.S.

EXHIBITIONS.

As usual an exhibit of farm products was made at the New Brunswick Provincial Exhibition, at Fredericton, N.B., and at the Nova Scotia Provincial Exhibition, at Halifax, N.S. I also attended the Middleton Exhibition, the Sackville and Westmorland County Exhibition, and the Port Elgin Exhibition.

CORRESPONDENCE.

During the year 2,301 letters were received and 2,011 sent out, exclusive of reports, and circulars sent out with samples of grain.

VISITORS.

While a great many visited the Farm during the year, they were not nearly so numerous as in former years, on account of the many unsuitable train connections, no train going westward after 12 a.m. stopping at this station, making it practically impossible for visitors to reach here except by driving.

We are negotiating with the railway officials and hope to have the train arrangements improved this coming season.

WEATHER.

April, 1909, opened with fine weather until the 4th, when seven inches of snow fell. Snow fell on the 9th and again on the 26th, 2½ inches falling each day. Total snowfall for month, 12 inches.

Light rains fell on seven different dates, making a total rainfall of 2.37 inches for this month.

There were but seven days during this month that frost was not registered, the lowest being on the 6th, when 17° was registered.

May.—Rain fell on twelve different dates during this month, but none of the showers were heavy, the total rainfall being 3·06 inches. The balance of the month was fine but cold, frost being registered as late as the 26th. The actual sunshine for this month was ·52 of the possible number of hours.

Seeding commenced on the 25th, five days later than in 1908.

June was fine and very dry, no rain falling until the evening of the 12th, when ·03 inches fell. On the 18th ·05 inches fell, on the 21st ·03 inches fell, and on the 24th ·04 inches. The lowest temperature recorded was 31° on the 2nd, the highest

being 85° on the 26th. The actual sunshine for this month was ·73 of the possible number of hours.

July.—The weather during this month was very favourable to growing crops. Light rains fell on 13 different dates during the month, the total rainfall being 1·73 inches. The thermometer registered 80° or above on 8 different days, the highest being 85° on both the 27th and 28th, the actual sunshine was ·53 of the possible number of hours.

August.—From the first to the 9th was a series of fine days with high temperatures, the highest being on the 8th when 87° was registered. Rain fell on the night of the 9th, from when until the 12th, over 2 inches fell. On the 18th, ·45 inches, and from the 25th to the 29th 1·05 inches fell, making a total for the month of 3·66 inches. The balance of the month although clear, was comparatively cool, the mercury hovering between 59° and 70°. The actual sunshine was ·65 of the possible number of hours.

September.—The weather during this month was very wet and cold. Rain fell on 12 different dates, the total rainfall being 4·07 inches. Frost was registered on the 20th, the highest temperature for this month being 79° on the 24th, actual sunshine being ·55 of the possible number of hours.

October.—With the exception of six days from the 5th to the 11th, the weather during October was very dull, rain falling on 12 different dates, with only 46 hours of sunshine during the last two weeks. Frost was registered on the 21st and 22nd and again on the 30th and 31st, when the thermometer fell to 24°. The actual sunshine was only ·45 of the possible number of hours.

November.—This was not a good month for getting fall farm work done. The weather was dull with considerable rainfall, 3·34 inches having fallen. Frost was registered on 17 different dates, the lowest being on the night of the 20th when the mercury dropped to 16°. The actual sunshine was only ·25 of the possible number of hours.

December was very broken, with light rains and snow falls. The heaviest snowfall was on the 21st when 12 inches fell, making good sleighing. The snowfall for the month was 28 inches, and total precipitation 4·63 inches. At no time during the last two weeks did the thermometer rise above 32°. The lowest temperature recorded was on the 29th, when the mercury dropped to 13° below zero. The temperature on the 30th was 14° above zero and on the 31st 1° below zero.

January, 1910.—January was very seasonable until the 19th, from which date until the end of the month rain fell on 10 different dates, taking off the snow and causing high temperatures until the 30th. The heaviest snowfall being 3 inches on the 31st, and the heaviest rainfall being ·61 inches on the 25th. Total precipitation for the month was 3·86 inches. There were only 21 hours of sunshine during the last two weeks of this month.

February was a typical winter month with barely snowfall enough to keep roads good, and no great amount of rain. The highest temperature was 43° on the 21st and 27th, and the lowest was 16° below zero on the 26th. The total precipitation for the month was 3·73 inches.

March was very mild with unseasonably high temperatures and a fair amount of sunshine. The ground was bare all the month. Rain fell on 9 different dates, making a total rainfall of 2·37 inches for the month.

METEOROLOGICAL RECORDS.

Month.	Degrees of temperature F.					Sunshine.
1909.	Highest.	Date.	Lowest.	Date.	Mean.	Hours.
April	63·0	14	17·0	6	36·28	178·5
May	73·0	28	29·0	17	47·83	242 5
June	85·0	26	31·0	2	59·41	346·0
July	85·0	28	41·0	3	63·85	252·0
August	87·0	8	43·0	31	63·14	286·0
September	79·0	24	32·0	20	58·56	208·0
October	75·0	9	24·0	31	47·93	154·0
November	65·0	3	16·0	20	38·36	116·5
December	40·0	4	— 13·0	29	24·78	56·5
1910.						
January	53·0	29	— 10·0	1	23·32	83·5
February	43·0	21	— 16·0	26	20·12	115·5
March	47·0	20	10·0	3	31·48	178·0
Total number of hours sunshine						2217·0

PRECIPITATION.

Month.	Rainfall.	Snowfall.	Total Precipitation.
1909.	Inches.	Inches.	Inches.
April	2·37	12	3·57
May	3·06	....	3·06
June	1·08	....	1·08
July	2·68	....	2 68
August	3·66	....	3 66
September	4·07	....	4·07
October	4·16	....	4·16
November	3·34	....	3·34
December	1·83	28	4·63
1910			
January	3·86	9	4·76
February	1·63	21	3·73
March	2·37	....	2·37
Totals	34 11	*70	41·11

*** Ten inches of snowfall is reckoned as equivalent to 1 inch of rainfall.**

I have the honour to be, sir,

Your obedient servant,

R. ROBERTSON,

Superintendent.

EXPERIMENTAL FARM FOR PRINCE EDWARD ISLAND

J. A. CLARK, B.S.A., SUPERINTENDENT.

CHARLOTTETOWN, P.E.I., March 31, 1910.

DR. WM. SAUNDERS, C.M.G.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith my report of the work done on the Experimental Farm for Prince Edward Island at Charlottetown, since possession was obtained of a part of the property in August, 1909.

DESCRIPTION OF FARM.

The farm was bought by the provincial government and leased to the federal Department of Agriculture. Possession was given of the 'Ravenwood' property August 14, 1909, and of the several other properties January 28, 1910. The east part of the Johnson property, though conveyed, is held by Mr. Albert Mutch under a former lease, which does not expire for seven years. The Beers property, though promised, can not be conveyed at present.

The properties included in the farm now held by the federal government are as follows:—

		Acres.
The Pope property (Ravenwood)		29·5
The Chandler property		6·143
The Gay property		2·2
The Blake property		14·71
The west part of the Johnson property		4·9
		57·45
Properties to be included later:—	Acres.	
The east part of the Johnson property	6·85	
The Beer property	1·5	
		8·35
In all		65·8

These properties extend from the corporation limits of the city of Charlottetown north along the east side of the Prince Edward Island Railway to the De Blois road, a distance of about three-quarters of a mile. They occupy all that block of land, which lies between the railway on the west, the Mount Edward road on the east, the De Blois road on the north, and the corporation limits of Charlottetown on the south, with the exception of nine acres on the northeast corner which is owned and occupied by Judge R. R. Fitzgerald.

The cross-road from St. Avards to Gaytown passes through the Farm between the Pope and Chandler properties.

The Chandler and Gay properties are in very good condition, having been well covered with a clover sod during the autumn of 1909 with the exception of three small, low areas which need drainage. The greater part of the Pope property was in very poor condition; the land had been overcropped without being manured, noxious weeds and natural grasses had possession; the orchard was neglected and the hedges so dilapidated that they had to be removed. About ten acres of this property is woodland, covered in the main with a strong vigorous growth of hardwood and a dense undergrowth of fir and spruce. An acre and a half along the cross-road from St. Avards was swamp, grown up with trees of tamarack, spruce and birch. On the high ground to the northwest of the buildings there is a pond, below this the soil is a good sandy loam until near the margin of the railway, where there is about an acre of light soil which is wet the greater part of the summer. The soil, with these exceptions, is a sandy loam and should, when in condition, be very suitable for experimental purposes as it represents the average type of soil on Prince Edward Island. The west part of the Johnson property is quite mossy. It has been in pasture for about fifteen years. This land slopes towards the west and, from the base of the hill to the railway, is wet and needs draining. A tile drain running parallel with the base of the hill would probably carry off this seepage. The Blake property was partly under roots last season, the remainder, which was in grain, will require to be drained. The soil is a sandy loam with areas of clay loam and underlaid with a heavy brick clay. It is fairly uniform in character and should be a good place to conduct variety tests. There are two small ponds near the De Blois road formed by excavating brick clay for pottery.

CHARACTER OF SEASON.

In the spring of 1909 the snow and ice went early from the fields and rivers. There were but few hot days, the weather was dull, dry and cold, due largely to heavy bodies of sea-ice along the north shore of the province. Seeding was late. The grasses and clovers remained almost at a standstill during the last half of May and the most of June. July and the early part of August was beautiful growing weather. The hay crop was saved in splendid condition. Great difficulty was experienced in harvesting the grain and root crops owing to an unusually wet harvest time and autumn. Winter began with very heavy snow falls, which lay level over the fields. This was followed by a great January thaw, which took almost all the snow away very quickly, there being no frost in the ground. The remainder of the winter has been remarkably mild, the thermometer reaching zero only occasionally and for very short periods of time.

WEATHER.

On April 4, 1909, 4 inches of snow fell; the weather from that on was fine and mild the 14th being very warm. On the 15th, 1 inch of rain fell; from that to the end of the month it was dull and cool. Rain fell on the 19th, 22nd and 23rd, and there were snow flurries on the 17th and 29th.

May was showery and cool with only two frosts, 1° on the 17th and on the 21st 5° of frost. Seeding became general about the 15th.

June came in cool, fine and dry and remained so until the middle of the month; light showers fell on the 14th, 15th, 18th, 21st, 24th, 25th, and 28th.

July commenced with pleasantly warm temperatures and occasional light showers; on the 9th and 19th heavy rains fell.

August was fine and dry up to the 8th. From then until the evening of the 11th 5½ inches of rain fell. The weather during the remainder of the month was more or less broken.

September was wet.

October began cool with heavy rains. The first frost came the 8th, 3 degrees. The whole month was cold and wet; five days only without rain. The first snow fell on the 30th.

November had much cloudy, wet weather. There was no frost that stopped the plough.

December came in rough, with rain. On the 20th, winter weather commenced; two feet of snow fell between that date and the 23rd; during the remainder of the month more snow fell.

January, 1910, opened bright and clear with occasional snow flurries, followed by some rain. A smooth coat of about two feet of packed snow lay everywhere without any frost being in the ground. On the 18th a thaw commenced which carried away almost all the snow. The remainder of the month was mild with high temperatures.

February began very mild, turning a little colder by the 8th, when the thermometer registered zero. The weather was fine and bright up to the 18th, when about 8 inches of snow fell. The month ended clear and frosty.

March came in fine and mild; light falls of snow were followed by a thaw, which took away almost all the snow by the 15th. The warmest day was the 20th, 46 degrees above zero. The month closed bright.

FENCES.

There was no satisfactory fence on the Farm when possession was taken. New fences have been erected along the entire railway side of the Farm and on either side of the cross-road from St. Avards.

BUILDINGS.

A two-story residence on the Pope property has been put in a thorough state of repair for the Superintendent. It contains ten rooms, one of which is to be used as an office. The largest barn was repaired temporarily and the roof tightened to keep the machinery and horses dry during the winter. The other outbuildings are of very little value.

GENERAL WORK.

All of the cleared land (about 19 acres) on the Pope property was broken during the autumn of 1909. Several rows of large trees, together with the cross-fences, were removed and the stumps taken out. The orchard and garden were cleaned up, all the rubbish being burned. Some large trees that were overhanging the house were stumped out. The swamp land on either side of the road from St. Avards was cleared of trees and the wood cut up for firewood. A drainage well was sunk in the swamp and a silt basin built. This well and the drains that were opened have taken off all the surface water near them. The Fairbank scales, supplied from the Central Farm at Ottawa, was placed on a cement foundation near the entrance to the barn. More than seven hundred feet of galvanized iron pipe was laid below the frost (all joints being carefully leaded and boxed with cement) to carry the city water from the Mount Edward road main to the house and barn. A sewage system was also laid from the house to a cesspool. About 100 tons of manure has been hauled from the city.

HORSES.

Two horses have been bought for the Farm—a heavy driving horse, six years old, and a heavy draft mare, five years old. The remaining horses needed will be purchased later.

TREES, SHRUBS AND PLANTS.

An acre of sod land was prepared as well as was possible under the circumstances between the house and the Mount Edward road and the following material, supplied from the Central Experimental Farm at Ottawa, was set out or placed in nursery rows on November 10, 11 and 12, 1909, to be ready for planting in the spring of 1910:—

50 Japan Barberry (*Berberis Thunbergii*).
50 Ginnalian maples (*Acer ginnala*).
A collection of Irises of twenty-six varieties.
A collection of Asters of twenty-four varieties.
Platycodon, white, two specimens
Platycodon, blue, five specimens.
10 *Syringa Japonica.*
10 *Syringa Emodi.*

A plantation of currants was made, the bushes being put out in rows, 6 feet apart in the rows. In the collection there were fifteen varieties of black currants, fifteen varieties of red currants and six varieties of white currants. A number of rose bushes, pæonies, perennial phlox, daffodils and lilacs were removed from an old garden formerly in use and were placed in the nursery rows.

EXHIBITIONS AND SEED FAIRS.

I have attended the following exhibitions and seed fairs, judging and giving addresses: Summerside, County Exhibition, Sept. 17 and 18, 1909; Charlottetown, Provincial Exhibition, Sept. 20 to 24, 1909; Georgetown, County Exhibition, Sept. 30, 1909; Egmont Bay, Institute Exhibition, Oct. 19, 1909; Tracadie, Institute Exhibition, Nov. 3, 1909; Maritime Live Stock Show, Amherst, N.S., Dec. 6 to 10, 1909; Prince Edward Island Fruit Growers' Association and Fruit Show, Dec. 3, 1909; Prince Edward Island Poultry Show, Jan. 5 to 7, 1910; Georgetown Seed Fair, Mar. 7, 1910; Summerside Seed Fair, Mar. 9 to 11, 1910.

AGRICULTURAL MEETINGS.

I have attended and delivered addresses at the following Farmers' Institute meetings: Central Lot 16, Prince county, Dec. 15, 1909; Miscouche, Prince county, Dec. 16, 1909; Park Corner, Queens County, Dec. 20, 1909; Malpeque, Prince county, Dec. 21, 1909; New Glasgow, Queens county, Jan. 10, 1910; Clyde River, Queens county, Jan. 15, 1910; Morell Rear, Kings county, Jan. 17, 1910; Hazlebrook, Queens county, Feb. 1, 1910; Alberry Plains, Queens county, Feb. 2, 1910; Fredericton, Queens county, Feb. 7, 1910; Rustico, Queens county, Feb. 9, 1910; North Milton, Queens county, Feb. 10, 1910; Tracadie, Queens county, Feb. 11, 1910; Bloomfield, Prince county, Feb. 14, 1910; Palmer Road, Prince county, Feb. 15, 1910; Springfield, Lot 8, Prince county, Feb. 16, 1910; Glenwood, Prince county, Feb. 16, 1910; West Devon, Prince county, Feb. 17, 1910; Coleman, Prince county, Feb. 17, 1910; Polo Bay, Kings county, Feb. 22, 1910; Red House, Kings county, Feb. 23, 1910; St. Margarets, Kings county, Feb. 24, 1910; Kingsboro, Kings county, Feb. 25, 1910; Marshfield, Kings county, Feb. 28, 1910; Grand River, Prince county, March 2, 1910; Tyne Valley, Prince county, Mar. 2, 1910; North Tryon, Prince county, Mar. 3, 1910.

DAIRY MEETINGS.

Stanley Bridge, Queens county, Feb. 8, 1910; Charlottetown, P.E.I., Dairymens' Association, Feb. 22, 1910.

METEOROLOGICAL RECORDS.

Months.	Temperatures F.					Rainfall.		Snowfall.		Total Precipi-tation.	Bright Sunshine.
	Maximum.		Minimum.		Monthly Mean.						
1901	Date.	°	Date.	°	°	Days	In.	Days	In.	Inches	Hours.
April.	14	59	12	21	35·9	10	2·75	7	14·5	4·2	158
May.......	28	72	1	30	46·3	16	3·1	0	0	3·1	191
June.......	26	87	2	37	60·3	6	·73	0	0	·73	281
Jnly........	29	86	3	49	66·1	11	3·31	0	0	3·31	242
August.	8	87·5	31	45	66·2	11	5·54	0	0	5·54	265
September...	24	78	20	41	60·1	11	3·84	0	0	3·84	187
October.....	9	71	31	32	50·1	17	7·27	1	·6	7·33	97
November ..	4	59	20	21	39·5	14	2·18	4	2·4	2·42	101
December...	4	44	29	4	28·1	8	2·06	16	43 8	6·44	20
1910											
January	29	47	14	8	24·2	10	3·24	8	15.2	4·76	59
February ...	27	41	25	0	21·2	4	1·54	7	20·7	3 61	105
March......	20	46	7	14	30·1	8	1·64	5	10·6	2·7	146 6
Total annual						126	37·20	48	107·8*	47·98	1.852·6

*Ten inches of snowfall is reckoned as equivalent to one inch of rainfall.

CORRESPONDENCE.

For the eight months ending March 31, 1910, there were 160 letters received and 122 sent out, not including circulars.

I have the honour to be, sir,

Your obedient servant,

J. A. CLARK,

Superintendent.

EXPERIMENTAL FARM FOR MANITOBA

REPORT OF JAS. MURRAY, B.S.A., SUPERINTENDENT.

BRANDON, MAN., March 31, 1910.

To Dr. WM. SAUNDERS, C.M.G.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to present herewith the twenty-second annual report of the Experimental Farm for Manitoba at Brandon, giving the results of experiments undertaken during the past year.

The winter of 1908-09 was unusually severe and steady in Manitoba and the spring backward and cold. The snow disappeared early in April, but sharp frost at night continued until the end of the month, so that there was very little growth before the first of May. During April, there were only two days on which any work could be done on the land, and it was May 5 before the work could be continued uninterrupted by frost.

When the weather finally did warm up early in May we had splendid growing weather. The soil was well supplied with moisture and the temperature seldom dropped to freezing. Frost was registered on May 16, when six degrees were recorded, and again on June 14, four degrees. No appreciable damage was done by either of these frosts. Growing conditions during May continued so favourable that, by the first of June, crops were little behind what they had been on that date of the previous year, when seeding started three weeks earlier.

During the early part of June, the precipitation was less than usual and, by the time rain fell on the 25th and 26th, late-sown crops were in need of moisture but did not suffer.

Frequent timely rains with warm weather through July gave continuous good growth and, by the end of the month, all crops were well advanced and the early varieties of wheat and barley were beginning to colour.

August was unusually dry. The mean temperature for the month was 66·2 degrees, and on only two days did it fail to reach 70 degrees, while it was over 80 degrees on eighteen days. Less than half an inch of rain was registered duriug the month and this all fell during the first week. In many parts of Manitoba, the dry weather set in much earlier and the excessive heat ripened the grain so quickly that the yield and quality were seriously affected. The loss from this cause was not so great on the Experimental Farm or in this district, as in many parts of Manitoba, but was considerable.

Harvest started on August 10, and continued without interruption until completed. The harvest and threshing season was favoured with unbroken fine weather, and the crop in all parts of the province was saved without loss and in good time. Threshing was completed about a month earlier than usual.

The first frost was registered on August 29, when the temperature dropped to 30·5 degrees. No damage was done to grain, but the crop of corn was affected as well as some of the garden crops. No more frost was recorded until September 22.

The exceedingly dry weather during August and September left the ground hard and dry for fall ploughing but, as threshing was completed early, fully the usual amount of ploughing was done before the winter set in.

The first snow fell on November 11, but severe weather did not commence until two weeks later. December was the coldest month of the winter and the most stormy. The unusually low temperature of 45 degrees below zero was recorded on December 9. The remainder of the winter was almost ideal, the only extremely cold snap being fourteen days in February. The sleighing was good until March 10; after this date the snow disappeared very rapidly and the fields were bare by the 18th. The ground being very dry, it absorbed the water as the snow melted and the high land was fit for work by the 22nd. Several rains and a light snowfall prevented any field work being done on the Experimental Farm, but the indications point to a much earlier spring than last year.

EXPERIMENTS WITH SPRING WHEAT.

The crop of wheat in 1909 was very satisfactory, particularly in view of the late date of sowing. The yields under field conditions varied greatly according to the nature of the land, the way it had been cropped, and the variety of grain sown. The heaviest yield was produced on the land that had been summer-fallowed the previous year, but, as is usually the case on this Farm, such crops were badly lodged and difficult to handle.

Spring Wheat—Test of Varieties.

Fourteen varieties were sown this year in uniform trial plots of one-twentieth acre each, on clay loam that had been fallowed the previous year. They were sown May 7 at the rate of one and one-half bushels per acre, and made a most satisfactory growth throughout the season. The dry, hot weather early in August ripened the grain very quickly and no doubt reduced the yield somewhat. The time required to mature was less than usual, owing mainly to the lateness of sowing but partly to the very warm weather in August, which hastened ripening.

There were no new varieties under test this year.

Number of Plot.	Name of Variety.	Date of ripening.		No. of days maturing.	Length of Straw, including Head.	Character of Straw.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured bushel after cleaning.	Rusted.
							In.		Lbs.	Bush.	Lbs.	Lbs.	
1	Pringle's Champlain...	Aug.	15	100	46	Fair ..	3	Bearded..	4,760	50	10	62½	Slightly.
2	Preston.	"	15	100	44	Stiff ...	3¼	" ..	4,490	48	30	62½	"
3	Huron	"	18	103	46	Fair ...	3½	" ..	5,500	47	40	61½	"
4	Minnesota 188.........	"	15	100	45	Stiff ...	3¼	" ..	4,920	47	30	60	"
5	Percy.....	"	15	100	44	"	3¼	Beardless.	4,670	46	10	61½	"
6	Hungarian White......	"	17	102	46	Fair ...	3¼	Bearded..	4,450	45	50	61½	"
7	Riga..	"	13	98	42	Stiff ...	3	Beardless.	3,590	45	10	61¼	"
8	White Fife............	"	21	106	46	"	3	" .	4,530	44	50	61	"
9	Marquis........... .	"	14	99	46	"	3	" .	3,670	43	20	63¾	Very slightly.
10	Bishop...............	"	13	98	40	Fair ...	3¼	" .	3,410	42	10	60½	Slightly.
11	Stanley...............	"	17	102	46	Stiff ...	3¼	" .	4,950	42	10	60	Very slightly.
12	Red Fife..............	"	19	104	47	"	3	" .	4,190	40	10	62¼	"
13	Chelsea	"	11	96	44	"	3	" .	3,570	37	10	60¼	"
14	Registered Red Fife...	"	19	104	48	"	3	" .	4,900	35	..	59	"

Spring Wheat.—Test of Varieties.

AVERAGE OF FIVE YEARS.

The following table gives the average yield and the average number of days maturing of six of the leading varieties of wheat, all but one for the past five years. Marquis is included in the list although it has been grown for two years only.

Varieties tested.	Average days maturing.	Average yield per acre. Bush.	Lbs.
Preston	118	43	32
Huron	117	41	27
Red Fife	121	41	14
White Fife	122	40	4
Stanley	117	37	11
Marquis (two years)	107	46	15

The average number of days required by Marquis to mature as given in this table is misleading, as the variety has been under test for two years only. As compared with Red Fife there was an actual difference in favour of Marquis of five days in 1908 and six days in 1909. Marquis and Stanley are early beardless varieties. Preston and Huron are early bearded sorts.

FIELD CROPS OF SPRING WHEAT.

Marquis and Chelsea were grown in field lots for the first time last year and gave a very good account of themselves. Six different varieties of wheat were sown in fields of from four to twenty acres each, but, as the conditions of soil were not uniform, the yields are not comparable. The wheat on summer-fallow was much too heavy in straw to be satisfactory, as much of it lodged early and the sample was injured in consequence. Two different lots of wheat were sown on Indian corn stubble and gave splendid crops. The yield was as high as on summer-fallow and the crops were much easier harvested, as there was less straw. To get a good crop of wheat by growing it this way, the land should be manured for the corn and the corn crop cultivated to keep the weeds down. With clean land, it is not advisable to plough for the wheat as the corn stubble keeps the land too open. Harrowing both ways in the spring will break the crust and form a mulch and the seed may then be sown on a firm seed-bed.

The stubble does not interfere with the seed drill, and by harvest time it has decayed and is not in the way of fall ploughing.

The following table gives the acreage, average yield per acre and total yield of the different varieties grown in field lots last year.

FIELD LOTS OF WHEAT.

Variety.	No. of acres.	Yield per acre. Bush.	Lbs.	Total yield. Bush.
Red Fife	20·14	28	53	582
White Fife	4·06	35	10	143
Preston	11·7	23	55	280
Marquis	4·32	52	18	226
Pringle's Champlain	3·2	37	48	121
Chelsea	4·12	36	53	152
		Total....		1,564

A considerable quantity of this grain, 568 bushels in all, was sent to the Central Experimental Farm to be distributed in five-pound samples. Fifty-one five-pound samples of wheat were distributed direct from this Farm. There is a considerable demand here for pure seed wheat in quantity and there is a ready market for our surplus stock. During the past winter 441 bushels of wheat have been sold from the

Experimental Farm in lots of from 2 to 5 bushels, for seed purposes. Good strains of the leading varieties are disseminated in this way, and there is less danger of their being mixed with other varieties at harvest or threshing time than where small samples are distributed.

STANDARD AND COMMERCIAL GRADES OF WHEAT.

There is considerable wheat of poor quality produced every year that brings a comparatively low price on the market. There is always a temptation to sow this grain and sell the grain of higher grade.

In order to get some information on the comparative value for seeding purposes of the grains of different grades, samples were secured in the spring of 1908 of the various standard and commercial grades of wheat from Chief Inspector Horn, of Winnipeg. These were sown under uniform conditions on plots of one-twentieth acre each and the yield from each determined. The experiment was repeated in 1909. The conditions for growth as regards weather, soil and moisture-supply were very favourable both seasons. Under more adverse conditions, the differences between the higher and the lower grades might be expected to be greater.

The average results of the two years are given in the following table:—

Grade.	Yield per acre.		Weight per bushel.
	Bush.	Lbs.	Lbs.
No. 1 Hard	39	31	61
No. 1 Northern	39	16	61
No. 2 "	39	56	60½
No. 3 "	38	11	60
No. 4 "	38	1	60
No. 5 "	37	21	60
No. 6 "	35	21	60
Feed	27	21	59

It will be noticed that there is an almost steady decrease in yield from No. 1 Hard to Feed, and that between the lower grades there is a greater difference than between the higher grades. No. 2 Northern is the only grade that seems to be out of place. In 1908, No. 1 Hard outyielded No. 2 Northern, but in 1909 this was offset by a still higher yield from the lower grade seed wheat. No. 2 Northern is always good wheat and may be just as plump and well-matured as a higher grade but merely off colour. This may not affect its value for seed, provided the poor colour has not been caused by weathering that has affected the vitality.

It is the intention to repeat this experiment in 1910.

WINTER WHEAT.

Winter wheat has been sown repeatedly on this Farm but a crop has never been secured. It has usually been completely dead in the spring. On one or two occasions, a few plants were alive and a few sheaves were saved but a satisfactory crop has never been harvested.

Two bushels of Turkey Red wheat was obtained from the Experimental Farm at Lethbridge, Alta., in August, 1909. Three plots were sown on August 15 at the rate of one and one-half, one, and one-half bushels per acre, respectively. A second sowing was made a month later. The grain sown in August germinated well and covered

the ground fairly well by winter time, but that sown in September, owing to the extremely dry weather, did not come up. A good covering of snow lay on the land all winter and disappeared about the middle of March. The plots that were sown in August were very slightly winter-killed where the snow had been deepest but were fresh and green by the end of the month. The late sown grain came up almost as soon as the snow was away, and at the date of this report has made considerable growth.

SMUT PREVENTATIVES.

During the past twenty years, various chemicals have been tested to secure one for the prevention of smut in grain crops. Little difficulty has been experienced in controlling this disease in wheat or in oats, but no practicable method has yet been introduced that will entirely prevent it in barley. The formalin treatment has been found, after numerous trials, to be highly satisfactory. Formalin can now be secured almost everywhere; it is inexpensive, the solution is easily prepared, and its efficiency when properly applied is beyond doubt. One pound of formalin is sufficient to make thirty-two gallons of solution, and this quantity will easily cover forty bushels of wheat, or about twenty-eight of oats. Dipping and sprinkling have given equally good results, but carelessness in either method of treatment is sure to bring disappointment.

Bluestone has been found effective as a re-agent for destroying smut, but its use has not been attended with quite as satisfactory results as formalin. A bluestone solution of the proper streugth is prepared by dissolviug one pound of bluestone in six gallons of soft water. As with the formalin solution, it makes no difference how this solution is applied so long as every kernel of grain is thoroughly moistened.

Other treatments that have been on trial as preventatives of smut include those with sulphide of potassium, sulphate of iron, agricultural bluestone, massel powder, anti-fungi, salt, and hot water. None of these has proven to be nearly as effectual as either formalin or bluestone. The hot water treatment and the sulphide of potassium both effectively prevented the disease, but the methods of application are too tedious to permit of either treatment coming into general use. Agricultural bluestone and anti-fungi are both mixtures of copper sulphate and iron sulphate, and their effectiveness is dependent upon the proportion of sulphate of copper that they contain, sulphate of iron being of little value as a fungicide.

No satisfactory remedy has yet been discovered for the control of loose smut of wheat. This is a distinct disease from the stinking smut or bunt.

The seed wheat used for this test last year was not very smutty and no smut was observed in any of the plots where it was sown.

EXPERIMENTS WITH OATS.

The ripening season proved to be too hot and dry to give altogether satisfactory results with the crops of oats. They made a strong growth early in the season but ripened very quickly and the grain was lighter iu weight than it usually is. Several of the fields that were badly lodged, rusted considerably and this further impaired the quality of the grain.

OATS—Test of Varieties.

Twenty-five different varieties of oats were sown in uniform test plots of one-twentieth of an acre each. The land was a black clay loam that was in fallow in 1908.

The seed was sown on May 13 under excellent soil conditions at the rate of two bushels per acre. The germination was rapid and uniform and the growth until August 1 favourable in every respect. After this date, the extreme heat induced too rapid ripening.

The Registered Banner was grown from registered seed procured from a member of the Canadian Seed Growers' Association in 1908. 'Regenerated' Abundance was obtained from the Garton Pedigree Seed Company, while Orloff was furnished by the Steele Briggs Seed Company.

Daubeney and Orloff are both very early varieties, the former being a white oat, the latter a yellow.

OATS—Test of Varieties.

No. of Plot.	Name of Variety.	Date of ripening.	No. of days maturing.	Length of Straw, including Head	Character of Straw.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured bushel after cleaning.	Rusted.
				In.		In.		Lbs.	Bus.	Lbs	Lbs.	
1	Improved American.	Aug. 15	94	56	Stiff.. ..	8½	Branching	4,670	119	24	40½	None.
2	Danish Island. ...	" 14	93	54	"	8½	" ..	3,860	119	14	40½	Very slightly.
3	Registered Banner...	" 13	92	54	"	8½	" ..	4,470	115	20	39	"
4	Banner..............	" 12	91	55	"	9	" ..	4,750	110	20	40½	None.
5	Alsasman	" 12	91	52	"	8	" ..	3,080	110	20	41	Very slightly.
6	Orloff...	" 6	85	38	"	7½	" ..	2,980	110	..	35	None.
7	Swedish Select......	" 13	92	53	Fair.. ..	8	" ..	1,670	109	24	41	"
8	Golden Beauty......	" 13	92	50	" ...	8½	" ..	1,760	109	14	38½	Very slightly.
9	Twentieth Century..	" 11	90	50	Stiff.. ..	8½	" ..	3,150	108	28	41	"
10	Irish Victor.........	" 14	93	50	"	8	" ..	3,560	108	18	39¾	None.
11	Pioneer............	" 14	93	49	Fair.. ..	8	" ..	2,920	107	2	40	Very slightly.
12	Kendal White.	" 13	92	55	"	8½	" ..	4,400	105	10	40½	"
13	American Triumph..	" 12	91	50	Stiff....	8	" ..	2,900	105	10	41	None.
14	Wide Awake........	" 13	92	50	Fair.. ..	7½	" ..	1,890	105	..	41	"
15	"Regenerated" Abundance....	" 13	92	50	Weak ..	7½	" ..	4,240	104	14	40	Very slightly.
16	Siberian...........	" 11	90	49	Stiff.. ..	7½	" ..	4,050	104	4	40½	None.
17	Improved Ligowo...	" 13	92	56	"	8	" ..	3,080	103	18	41½	Considerably.
18	White Giant	" 14	93	54	Fair.. .	9	" ..	3,460	99	14	42	Very slightly.
19	Virginia White......	" 14	93	50	" ...	7½	" ..	2,820	97	2	40½	"
20	Thousand Dollar. ..	" 12	91	52	Stiff....	8½	" ..	2,280	97	2	42½	None.
21	Abundance	" 15	94	50	Weak .	8	" ..	3,280	96	16	38½	Very slightly.
22	Lincoln....	" 15	94	47	"	9	" ..	1,760	80	..	36	Slightly.
23	Milford White.....	" 14	93	52	"	9½	Sided.....	3,460	75	30	37½	"
24	Daubeney	" 6	85	40	Stiff.. ..	7	Branching	3,940	69	16	37	None.
25	Storm King.........	" 12	91	52	"	9	Sided.....	4,400	66	16	39½	Slightly.

OATS—TEST OF VARIETIES.

AVERAGE YIELD FOR FIVE YEARS.

The following table gives the average yield of a number of the leading varieties of oats for the past five years:—

Variety.	Average days maturing.	Average yield per Acre.		Variety.	Average days maturing.	Average yield per Acre.	
		Bush.	Lbs.			Bush.	Lbs.
Improved American......	106	123	1	Abundance........	107	109	33
Banner....	106	119	27	Thousand Dollar.........	105	105	10
Danish Island......	107	117	28	Storm King......	105	91	17
Golden Beauty...........	108	115	4	Daubeney....	89	78	10
Siberian..	107	111	32				

FIELD LOTS OF OATS.

Three different varieties of oats were sown in field lots, viz.: Banner, Thousand Dollar and Daubeney. The yields as given herewith are not comparable, as the several varieties were sown at different dates and under different conditions.

Variety.	No. of Acres.		Yield per Acre.		Total Yield.
			Bush.	Lbs.	Bush.
Banner	36	88	61		2,188
Thousand Dollar	9	4	72	11	680
Daubeney	7	45	58	8	434
Total					3,302

EXPERIMENTS WITH BARLEY.

The yields of barley both in the plots and in the fields were quite satisfactory. Most of the crop was well advanced before the extremely warm weather set in and the yield was not seriously affected.

The barley crop merits more attention at the hands of Manitoba farmers than it has been heretofore accorded. This it will probably receive as the demand grows for feeding and malting purposes. It is an ideal feed for the production of pork, particularly when fed mixed with small quantities of peas or oil meal. It is largely used as a feed for fattening steers and is excellent for this purpose. Barley has usually been grown in Manitoba as a cleaning crop as it can be sown late in the spring after one or two crops of weeds have been killed with the harrows and cultivator, and be harvested before wild oats have shelled to any extent. It is not usually of the first quality when grown in this way.

Barley will make good use of manure ploughed under in the spring, and, when the barley crop comes off early, the land then may be prepared for wheat the next year. The disc harrow should be used on the stubble as soon as possible after harvest to cover the shelled grain and induce germination. The land may then be fall ploughed and made ready for wheat in the spring.

BARLEY AS A SMOTHER CROP.

Couch grass or Twitch grass (*Agropyrum repens*) is a most difficult weed to eradicate in the heavy soils of Manitoba. It does not usually spread much by seed but mainly by underground root-stalks which are extremely tough and wiry. Summer fallowing is usually resorted to as a means of eradicating persistent weeds, but, with Couch grass, this system is often not effective. In a wet season, it is almost impossible to keep the growth in check, and the cultivation is often just enough to stimulate the plants and make them grow more rapidly. Harrows and cultivators also drag the roots to parts of the field not before infested and thus make conditions worse than before.

In a dry season, summer-fallowing, if done thoroughly, is more effective, but even then it requires great care.

A field which has been more or less infested with Couch grass for some years was summer-fallowed in 1908. The season did not enable us to make satisfactory headway against the weed and, in the fall, the condition of the field was very little, if any, better than it had been the previous spring.

In the spring of 1909, the field was allowed to lie undisturbed until after seeding, by which time there was a strong growth of Couch grass on many parts of it.

The land was then ploughed deeply, about seven inches, and packed firmly. Barley was sown at once, at the rate of three bushels per acre.

The deep ploughing buried the plants well below the surface, as it is a shallow rooter. The conditions for growth were favourable and the barley germinated well and grew rapidly. The growing weather was ideal throughout the greater part of the summer, with the result that there was a rank growth of straw which effectively prevented the Couch grass making headway. The crop lodged considerably, but yielded 642 bushels from 12·2 acres.

By harvest time there was practically no Couch grass to be seen and, as the fall was usually hot and dry, it did not make any growth afterwards.

The success of this trial would indicate that barley may be used to good advantage in controlling Couch grass. The weather conditions throughout the season were very favourable or the results might not have been so fatal to the Couch grass. It is important that the ploughing be fairly deep and that the barley be sown immediately, otherwise it would not make sufficient headway to keep ahead of the Couch grass.

Barley.—Test of Varieties.

Eleven varieties of six-rowed and ten varieties of two-rowed barley were sown in uniform test plots of one-twentieth of an acre each. The land was clay loam that had been fallowed in 1908. The seed was sown May 17, at the rate of two bushels per acre. O.A.C., No. 21 is a selection of Mandscheuri, made at the Ontario Agricultural College, Guelph. It was tested here in 1908 for the first time. No rust was observed on any of the plots, except Danish Chevalier and Invincible, which were slightly affected.

Six-rowed Barley.—Test of Varieties.

No. of Plot.	Name of Variety.	Date of Ripening.		No. of days Maturing.	Length of Straw, including Head	Character of Straw.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured bushel after cleaning.
					Inches.		Inch.		Lbs.	Bush.	Lbs.	Lbs.
1	O.A.C. No. 21....	Aug.	8	83	42	Stiff..	3	Bearded	3,660	73	36	49
2	Mensury..............	"	8	83	39	"	3	"	2,870	72	44	50½
3	Mansfield............	"	9	84	39	Fair..	3	"	3,580	71	12	49¼
4	Yale....	"	10	85	40	Stiff,. ...	2¾	"	3,720	68	16	50
5	Stella...............	"	11	86	35	Fair.. . ..	2½	"	3,630	67	44	51½
6	Albert..............	"	7	82	33	Weak	2¾	"	3,470	65	40	51
7	Odessa	"	10	85	38	"	3	"	3,200	64	28	50¼
8	Trooper.....	"	11	86	36	Fair..	2¾	"	3,670	64	8	51
9	Oderbruch	"	8	83	35	Weak	2½	"	2,410	62	4	52½
10	Nugent....	"	9	84	35	Stiff..	2½	"	1,560	61	12	51
11	Claude.....	"	8	83	36	"	2½	"	4,220	57	44	49

TWO-ROWED BARLEY.—Test of Varieties.

No. of Plot.	Name of Variety.	Date of Ripening.	No. of days Maturing.	Length of Straw, including Head.	Character of Straw.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured bushel after cleaning.
				Inches.		Inch.		Lbs.	Bush.	Lbs.	Lbs.
1	Canadian Thorpe	Aug. 12	87	45	Fair..	3½	Bearded	4,300	65	20	51¾
2	Jarvis........	" 12	87	42	Stiff.. ...	4	"	2,960	63	16	52⅓
3	Beaver..	" 11	86	40	Fair..	4¼	"	3,820	60	20	51½
4	Gordon..............	" 11	86	45	Stiff.. ...	2⅓	"	4,960	59	8	49⅓
5	Standwell............	" 12	87	46	Fair..	3⅓	"	4,070	58	46	51⅓
6	Clifford.............	" 10	85	41	Stiff..	3¾	"	3,740	54	28	50⅓
7	Danish Chevalier	" 15	90	37	Weak	3⅓	"	3,880	50	20	50
8	French Chavalier......	" 11	86	42	Stiff..	3¼	"	3,760	50	..	51⅓
9	Swedish Chavalier.. ..	" 13	88	37	Weak	4	"	6,860	47	6	50½
10	Invincible......	" 15	90	38	Fair..	3½	"	4,340	43	46	52

BARLEY.—TEST OF VARIETIES.

AVERAGE YIELD IN FIVE YEARS.

Following is a list of a number of the leading varieties of barley and their average yield on this Farm for the last five years.

SIX-ROWED.

Variety.	Average Days Maturing.	Average Yield per Acre.	
		Bush.	Lbs.
Odessa..	88	63	47
Mensury.......................................	87	63	36
Yale..	88	63	10
Mansfield.....................................	88	62	30

TWO-ROWED.

Jarvis..	89	59	34
Standwell.....................................	91	59	33
Swedish Chevalier.............................	93	57	40
Canadian Thorpe...............................	90	58	18

FIELD CROPS OF BARLEY, 1909.

Variety.	Previous crop.	Number of acres.	Yield per acre.		Total yield.
			Bush.	Lbs.	Bush.
Mensury	Fallow (spring ploughed for couch grass)	12·02	52	29	642
"	Fallow	4·35	57	23	250
"	"	2 7	45	44	124
Odessa	Barley (spring ploughed)	5·00	36	29	183
Mensury	" "	4 33	42	45	186
	Total				1,385

EXPERIMENTS WITH FIELD PEAS.

The pea crop is not grown as extensively in Manitoba as its value warrants. It is probably the most valuable annual leguminous crop that we can grow. Like the other legumes, it is able to utilize the nitrogen of the air in its growth and stores considerable of it in its roots. This goes to enrich the land when the crop is removed. It is a rank-growing crop and might be used to advantage in this province as a green crop to plough down to increase the humus of the soil, as clover does not attain sufficient size in one season here to make it valuable for that purpose. Peas will produce an immense growth in from eight to ten weeks and analyses prove that the growth contains about 130 pounds of nitrogen per acre. A considerable proportion of this is undoubtedly obtained from the atmosphere.

The pea crop is also valuable when ripened. The grain is very rich in protein and when mixed with other grains, is a very valuable feed for milch cows and hogs. The straw is excellent for sheep-feed, if cut before thoroughly ripe.

When being grown for feed, peas are best sown mixed with oats at the rate of three bushels per acre, equal parts by weight. They may then be cut with the binder. This mixture also makes an excellent soiling crop for milch cows for the early part of the summer.

When grown alone, they are best harvested with the pea-harvester attachment to the mower.

FIELD PEAS—TEST OF VARIETIES.

Sixteen varieties were grown under uniform conditions on plots of one-twentieth of an acre each. The land was a clay loam that had been fallowed in 1908. The seed was sown May 8 at the rate of from two to three bushels per acre, depending on the size of the pea.

PEAS—Test of Varieties.

No. of Plot.	Name of Variety.	Date of Ripening.	Number of days Maturing.	Character of Growth.	Length of Straw.	Length of pod.	Size of Pea.	Yield per Acre.		Weight per Bushel.
					Inches.	In.		Bush.	Lbs.	Lbs.
1	Mackay	Aug. 27	111	Medium	49	2¼	Medium	46	45	63½
2	Prince	" 30	114	"	46	2¼	"	44	15	64
3	Gregory	" 28	112	Rank	55	2½	Large	40	45	65
4	Golden Vine	Sept. 1	116	"	56	2	Small	40	25	65¼
5	Chancellor	Aug. 26	110	Medium	52	2	"	40	25	65
6	English Grey	Sept. 1	116	"	50	2½	Medium	39	5	63¾
7	Victoria	" 3	118	Very rank	63	2½	"	39	5	64
8	Paragon	Aug. 29	113	Rank	56	2½	"	38	45	63
9	Wisconsin Blue	" 28	112	Medium	50	2¼	Small	38	25	65
10	Arthur	" 30	114	"	48	2½	Medium	37	25	64
11	Black-eye Marrowfat	Sept. 7	122	Very rank	66	2½	Large	37	25	63½
12	Early Britain	Aug. 31	115	Medium	49	2¼	"	37	5	62
13	Prussian Blue	" 27	111	"	48	2½	Medium	35	45	63
14	Daniel O'Rourke	" 31	115	Rank	58	2	Small	34	5	64½
15	Picton	" 29	113	Medium	49	2¼	"	33	5	64¼
16	White Marrowfat	Sept. 6	121	Very rank	69	2½	Large	32	5	63½

FIELD CROP OF PEAS.

Variety.	Number of acres.	Preparation of land.	Yield per acre.		Total yield.
			Bush.	Lbs.	Bush.
Golden Vine	4·17	Fallow	35	44	149
Arthur	3·58	"	33	14	119
Daniel O'Rourke	4·71	"	26	45	126

MIXTURES OF GRAIN FOR GRAIN PRODUCTION.

An experiment was started this year to get some informatiou on the relative values of mixtures of various grains in different proportions for the production of grain for feed as compared with oats, barley and peas sown alone. There is more and more grain being grown for feed every year, and in this, as iu grain-growing for other purposes, the aim should be at the highest possible production per acre. If a mixture of two or three kinds of grain will produce more per acre than any of these grains sown singly, it is worth knowing and worth putting into practice.

The following table gives the yields from the various mixtures.

MIXTURES OF GRAIN.

Oats, 1 bu.;	barley, 1 bu.		3,840
" 1	" 1½		3,400
" 1½	" ½		3,380
" ½	" 1½		3,320
" 1	" 1	peas, 1 bu.	3,280
" 1½	" 1½		3,200
" 2		; peas, ½	3,200
" 1½		" ½	3,020

Oats, ½ bu.; barley, 1 bu.	2,400
" ½ " " 2	2,120
Banner oats	3,760
Daubeney oats	2,360
Mensury barley	2,362
Arthur peas	2,245

Daubeney oats and Mensury barley were used in the mixture of oats and barley, as these varieties ripen at nearly the same time. Arthur peas and Banner oats were used for the other mixtures.

ROTATION EXPERIMENTS.

In 1899, some experiments were started to test the feasibility of eliminating the bare summer-fallow from the system of farming in this province by substituting the ploughing down of some green leguminous crop every third year. On account of the land where these tests were in progress being repeatedly flooded, the work of the first three years was lost and these trials were started again in 1905 on another part of the Farm.

The system of rotation followed is given in the following tables, also the yields and other particulars of the crop produced in 1909:—

ROTATION TEST.

Number.	1907.	1908.	1909.
1	Wheat.	Peas.	Wheat.
2	Oats.	Tares.	"
3	Wheat.	Red Clover.	"
4	Barley.	Alfalfa and Alsike.	"
5	Peas.	Wheat.	"
6	Tares.	"	Oats.
7	Red Clover.	"	Wheat.
8	Alfalfa and Alsike.	"	Barley.
9	Wheat.	"	Peas.
10	"	Oats.	Tares.
11	"	Wheat.	Red Clover.
12	"	Barley.	Alfalfa and Alsike.
13	Summer-fallow.	Wheat.	Wheat.
14	"	"	Oats.
15	"	"	Barley.
16	Oats.	"	Wheat.
17	"	"	Barley.

ROTATION TEST.—RESULTS IN 1909.

No. of Plot.	Name of Variety.	Date of sowing.	Date of ripening.	Days maturing.	Length of straw.	Yield per acre.	
					In.	Bush.	Lbs.
1	Red Fife	May 7	Aug. 14	99	38	33	15
2	"	" 7	" 14	99	37	28	35
3	"	" 7	" 16	101	40	36	10
4	"	" 7	" 16	101	41	39	10
5	"	" 7	" 16	101	40	32	50
6	Banner	" 13	" 16	101	43	69	24
7	Red Fife	" 7	" 17	102	40	29	40
8	Mensury	" 17	" 19	104	37	28	46
9	Peas*						
10	Tares*						
11	Red Clover*						
12	Alfalfa and Alsike*						
13	Red Fife	May 7	Aug. 17	102	42	30	20
14	Banner	" 13	" 15	100	39	54	4
15	Mensury	" 17	" 19	104	42	25	20
16	Red Fife	" 7	" 16	101	36	25	10
17	Mensury	" 17	" 20	105	38	29	38

* Ploughed und 5 in May.

SUMMARY OF RESULTS OBTAINED FROM EXPERIMENTS IN CROP ROTATION AT BRANDON, MANITOBA, 1905-1909.

As rotation work in connection with field crops is now being introduced at the Brandon Farm on a much larger scale, it is not thought necessary to continue experiments on the smaller plots.

The work on the latter has, therefore, been summarized in the following tables and a short account of the method of conducting the experiments is given.

In the spring of 1899, arrangements were made for a series of rotation plots, the principal object being the maintaining of the fertility of the soil by the ploughing under of a leguminous crop every third year in place of the usual summer-fallow.

As the first field selected was flooded in 1902 and 1904, it was found unsuitable and a new location was selected in 1905.

The size of plot used was one-tenth acre. The Red Clover was sown at the rate of 12 pounds per acre and mixed clovers in the proportion of 8 pounds of Alfalfa and 6 pounds of Alsike per acre. These leguminous crops were ploughed under when they reached their fullest development.

Plots 13, 14, 15 give tests of grain growing with summer-fallow every third year instead of a leguminous crop and 16 and 17 of growing a grain crop every year.

The order of rotation was as follows:—

1905	1906.	1907.
1. Peas	Wheat	Wheat.
2. Tares	Wheat	Oats.
3. Red Clover	Wheat	Wheat.
4. Alfalfa and alsike	Wheat	Barley.
5. Wheat	Wheat	Peas.
6. Wheat	Oats	Tares.
7. Wheat	Wheat	Red Clover.
8. Wheat	Barley	Alfalfa and Alsike.
9. Wheat	Peas	Wheat.

	1905	1906.	1907.
10.	Oats	Tares	Wheat.
11.	Wheat	Red Clover	Wheat.
12.	Barley	Alfalfa and Alsike	Wheat.
13.	Wheat	Wheat	Summer-fallow.
14.	Wheat	Oats	Summer-fallow.
15.	Wheat	Barley	Summer-fallow.
16.	Wheat	Wheat	Oats.
17.	Wheat	Barley	Oats.

The average and total yield of each variety of grain on each plot has been worked out for the number of years each has been sown and the revenue from each plot for the five year period from 1905 to 1909, inclusive, found; wheat has been valued at 90c. per bushel, oats at 40c. and barley at 50c. per bushel.

No. of Plot.	Variety Grown.	1905.		1906.		1907.		1908.		1909.	
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.
	Peas	Peas.						Peas.			
	Wheat			33	30					33	15
1	Wheat					29	—				
	Tares	Tares						Tares.			
	Wheat			33	30					28	35
2	Oats					56	6				
	Red Clover	Clover						Clover			
	Wheat			30	40					36	10
3	Wheat					30	20				
	Alfalfa and Alsike	Alf. & Alsike.						Alf. & Alsike.			
	Wheat			30	10					39	10
4	Barley					39	18				
	Wheat	35	50					33	25		
	Wheat			30	10					32	50
5	Peas					Peas					
	Wheat	36	20					32	55		
	Oats			102	22					69	24
6	Tares					Tares					
	Wheat	35	00					33	5		
	Wheat			27	50					29	40
7	Red Clover					Red Clover					
	Wheat	33	00					34	30		
	Barley			52	04					28	46
8	Alfalfa and Alsike					Alfal. & Alsike					
	Wheat	33	30					27	10		
	Peas			Peas.						Peas.	
9	Wheat					39	40				
	Oats	105	00					57	22		
	Tares			Tares						Tares.	
10	Wheat					37	10				
	Wheat	35	20					24	15		
	Red Clover			Red Clover						Red Clover.	
11	Wheat					42	10				
	Barley	40	10					41	42		
	Alfalfa and Alsike			Alf. & Alsike.						Alf. & Alsike	
12	Wheat					41	20				
	Wheat	35	40					35	35		
	Wheat			28	50					30	20

No. of Plot.	Variety Grown.	1905.		1906.		1907.		1908.		1909.	
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.
13	Summer-fallow					Summ'r-fallow					
	Wheat	35	10					35	45		
	Oats			85	00						
14	Summer-fallow					Summ'r-fallow				54	4
	Wheat	38	10					36	25		
	Barley			46	22					25	20
15	Summer-fallow					Summ'r-fallow					
	Wheat	35	10					23	55		
	Wheat			28	40					25	10
16	Oats					105	00				
	Wheat	35	50					24	15		
	Barley			46	12					29	38
17	Oats					95	30				

No. of Plot.	Variety.	Average yield per acre.		Total yield per acre.		Total revenue per acre.	Total revenue per plot.
		Bush.	Lbs.	Bush.	Lbs.	$ cts.	$ cts.
	Wheat 2 years } " 1 year }	31	55	95	45	86 17	8 62
1	Peas 2 years						ploughed under.
	Wheat 2 years	31	02	62	05	55 88	
	Oats 1 year	56	06	56	06	22 47	7 84
						78 35	
2	Tares 2 years						ploughed under.
	Wheat 2 years } " 1 year }	32	23	97	10	87 45	8 75
3	Red Clover 2 years						ploughed under.
	Wheat 2 years	34	40	69	20	62 40	
	Barley 1 year	39	18	39	18	19 69	8 21
						82 09	
4	Alfalfa and Alsike 2 years						ploughed under.
	Wheat 2 years } " 2 " }	33	04	132	15	119 02	11 90
5	Peas 1 year						ploughed under.
	Wheat 2 years	34	37	69	15	62 32	
	Oats 2 years	86	06	172	12	68 94	13 13
						131 26	
6	Tares 1 year						ploughed under.
	Wheat 2 years } " 2 " }	31	24	125	35	113 02	11 30
7	Red Clover 1 year						ploughed under.
	Wheat 2 years	33	45	67	30	60 75	
	Barley 2 "	40	25	81	02	40 52	10 13
						101 27	
8	Alfalfa and Alsike 1 year						ploughed under.

No. of Plot.	Variety.	Average yield per acre.		Total yield per acre.		Total revenue per acre.	Total revenue per plot.
		Bush.	Lbs.	Bush.	Lbs.	$ cts.	$ cts.
9	Wheat 2 years ⎫ " 1 year ⎭	33	27	100	20	90 30	9 03
	Peas 2 years						ploughed under.
	Oats 2 years	81	11	162	22	65 06	
	Wheat 1 year	37	10	37	10	33 45	9 85
						98 51	
10	Tares 2 years						ploughed under.
11	Wheat 2 years ⎫ " 1 year ⎭	33	55	101	45	91 56	9 16
	Red Clover 1 year						ploughed under.
	Barley 2 years	41	02	82	04	41 05	
	Wheat 1 year	41	20	41	20	37 20	7 83
						78 25	
12	Alfalfa and Alsike 2 years						ploughed under
13	Wheat 2 years ⎫ " 2 " ⎭	32	36	130	25	117 37	11 74
	Summer-fallow 1 year						
	Wheat 2 years	35	27	70	55	63 82	
	Oats 2 years	69	19	139	04	51 65	11 94
						19 47	
14	Summer-fallow 1 year						
	Wheat 2 years	37	17	74	35	67 12	
	Barley 2 "	35	45	71	42	35 93	10 30
						103 05	
15	Summer-fallow 1 year						
	Wheat 2 years	28	14	112	55	101 62	
	Wheat 2 "	105	—	105	00	42 00	14 36
						143 62	
16	Oats 1 year						
	Wheat 2 years	30	02	60	05	54 08	
	Barley 2 "	38	01	76	02	38 02	
17	Oats 1 year	95	30	95	30	38 35	13 04
						130 45	

CORN AS A FODDER CROP FOR WESTERN CANADA.

Corn is one of the crops that, if better known, would be grown much more generally in Western Canada than it is. It is not a new crop but has been on trial for a great many years and has amply proven its worth. Its warmest advocates do not claim that it can be matured as successfully as it can further south, but those who have given it a fair trial will agree that it grows luxuriantly under our climatic and soil conditions and produces more good fodder per acre than any other crop we can grow. More than this, it responds to good treatment to an extent equalled by few other crops by giving a liberal return for manure applied and for cultivation through the growing season. The cultivation also aids materially in clearing the land of weeds and in preparing it for the next crop. If corn were more generally grown, the

solution of the weed question would be simplified and a stimulus given to more thorough farming.

Corn will thrive on any fertile, well-drained soil. A warm soil with a southern slope is preferred by some growers, but, although this may be an advantage, it is not necessary. To secure the most favourable conditions, I would recommend the ploughing of a field of sod in late summer after applying manure at the rate of about 16 tons per acre. The more the land can be worked before winter the better, and in the following spring it can do with little attention until after seeding though an occasional harrowing to kill weeds and check evaporation should be given. But to secure a good crop, a sod is not necessary. Stubble may be ploughed either in fall or in spring after the application of manure and worked down into good condition by the twentieth of May. The manuring should not be neglected, as no other crop on the farm will make better use of manure than will corn.

It is not advisable, in this latitude, to sow the larger late varieties, as they are so far from maturity when the season for cutting arrives that they are deficient in quality. The earlier varieties do not produce as great a bulk of feed per acre but it is of very much better quality. For two years we have grown Northwestern Dent for the bulk of our field corn and have found it very satisfactory. It grows from seven to nine feet high and, when planted about May 24, is ready for cutting by September 1 Longfellow, Compton's Early and North Dakota White are other good varieties, all somewhat larger growing, but considerably later, than Northwestern Dent. Mercer and Triumph are two other sorts that promise well.

It is not usually safe to sow before the twentieth of May but seeding should not be delayed after that date. Since corn planters are not likely to be in general use here for some time yet, the grain drill can be used. A sufficient number of spouts should be plugged up so that the drills will be from three to three and a half feet apart. The latter distance allows the cultivator to be used to better advantage. A common mistake is made in sowing corn too thickly in the row. About fifteen pounds is sufficient seed for an acre if it is evenly distributed, when the rows are three and a half feet apart. The stalks should not be closer together in the row than eight inches or there will be very few cobs formed. If it comes up any thicker than this it should be harrowed out.

The advice is sometimes given to sow corn on the weediest land as it is an excellent crop to clean land. That depends on the cultivation. If the crop is cultivated as it should be, it is a good land cleaner, but if it is not cultivated it is little better than any other grain crop. This work should start as soon as the corn is planted, and in its early stages should consist in running the harrow over the land every few days until the corn is six inches high. A few stalks will be rooted up but so also will myriads of weeds which are just starting to grow. The harrow is the cheapest weed destroyer we have if it is used at the proper time. After the harrows can no longer be used, either the one or the two-horse cultivator should be put to work and used as frequently as the other work will allow, or sufficiently often to keep weeds in check, and the soil stirred to a depth of two inches. Cultivation should not be deep at any time and should get shallower as the season advances. This may seem like a lot of cultivating, but, if one can keep the next year's crop in mind when doing the work, he will not think the time and labour spent such a loss. Besides destroying the weeds, the cultivation greatly stimulates the growth of the crop.

The most satisfactory method of harvesting the crop is by means of the corn binder which cuts a row at a time and binds it in sheaves. When several farmers in a district are growing corn, it is well worth while getting one of these machines. When a corn binder is not available, it is usually advisable to cut by hand, as the ordinary grain binder is far from satisfactory.

The ideal way to handle fodder corn after it is cut is by means of the silo as it is stored without loss and is available for feeding whenever required. There are few silos in use in Western Canada, but, as corn is grown in larger areas, they will

surely be more common, as they have been found to be a decided success in this climate wherever they have been given a fair trial.

When corn is to be fed as a dry fodder, it has to be cured by stooking as soon as cut. From 500 pounds to half a ton of corn may be put in one shock, tied firmly near the top with binder twine to prevent its blowing over. It may be drawn to the barn as required for feed during the winter and fed either whole or after being run through a cutting-box to either horses or cattle.

If the crop of corn has been worked as it should have been throughout the summer, very little work is required to put the land into first-class condition for the following crop. If the weeds have been kept down, there is no object in ploughing the land as this leaves the soil too loose and open on account of the corn roots being turned up. We have found it very satisfactory to sow the next year's grain crop after thoroughly harrowing the land. The corn roots are not disturbed, the soil is firm, and, by the end of the growing season, the roots have all rotted away and give no further trouble. For the past two years, the grain crops that we have harvested from land that was in corn the year previous were more satisfactory than those off summer-fallow.

INDIAN CORN—TEST OF VARIETIES.

Twenty varieties of Indian corn were grown under uniform conditions in 1909. The land, a clay loam, had been in corn the year before and was manured at the rate of 16 tons per acre and ploughed in the fall of 1908. The season of 1909 was an excellent one for corn, being unusually warm, and all varieties made excellent growth. Unfortunately, we had a slight frost on August 29 which withered the leaves. This reduced the weight somewhat but was not sufficient to seriously injure the quality. The corn was sown on June 7 and harvested on September 6. The yield per acre in each case was estimated from the product of two rows, each 66 feet long.

Indian Corn—Test of Varieties.

No. of Plot.	Name of Variety.	Character of growth.	Height.	Leafiness.	Condition when cut.	Weight per acre grown in rows.
			Inches.			Tons. Lbs.
1	Superior Fodder	Very rank	98	Fairly	Tassel	16 76
2	North Dakota White	Rank	100	"	Late milk	14 1,898
3	Mercer	Medium	91	"	Early "	14 710
4	Compton's Early	Rank	102	"	" "	14 116
5	Angel of Midnight	"	95	Very	Silk	13 1,720
6	Early Mastodon	Very rank	109	Fairly	Tassel	13 532
7	Mammoth Cuban	"	106	"	Early milk	13 532
8	White Cap Yellow Dent	"	113	"	" "	12 1,938
9	Eureka	"	109	"	Silk	12 552
10	Salzer's All Gold	"	105	"	Tassel	11 1,562
11	Champion White Pearl	"	114	"	"	11 1,562
12	Wood's Northern Dent	"	111	Very	Silk	11 968
13	Longfellow	"	110	"	"	11 968
14	Selected Leaming	"	110	Fairly	"	11 968
15	Northwestern Dent	Medium	94	"	Early dough	10 790
16	Golden Dent	"	86	"	" "	9 1,998
17	No. 23 Minnesota	"	92	"	" "	9 1,998
18	Triumph	"	78	"	Late milk	9 1,404
19	Davidson	"	83	"	Early dough	6 1,266
20	Paterson No. 1	Small, scrubby	66	"	Firm dough	5 890

INDIAN CORN—Test of Seeding at Different Distances.

Variety.	Distance apart.	Height.	Yield per acre.
	Inches.	Inches.	Tons. Lbs.
Longfellow	24	94	10 1,780
"	30	102	11 704
"	36	104	12 640
"	42	100	11 1,751
Selected Leaming	24	97	15 1,350
"	30	103	15 1,416
"	36	115	12 1,080
"	42	112	14 275
Champion White Pearl	24	100	14 1,040
" "	30	101	11 1,496
" "	36	99	12 1,740
" "	42	106	11 808½
Longfellow (Hill)	....	110	10 1,978
Selected Leaming (Hill)	....	115	11 770
Champion White Pearl (Hill)	... .	106	13 1,522

INDIAN CORN—Test of Seeding at Different Distances.—Average of 11 Years ending 1909.

Variety.	Distance apart.	Yield per acre.
	Inches.	Tons. Lbs.
Selected Leaming	24	19 1,563
"	30	19 1,232
"	36	18 1,728
"	42	17 525
Champion White Pearl	24	21 948
" "	30	20 540
" "	36	18 1,893
" "	42	17 1,893
Longfellow	24	17 820
"	30	18 1,250
"	36	19 259
"	42	18 566

AVERAGE of Three Varieties for Eleven Years.

Variety.	Distance apart.	Yield per acre.
	Inches.	Tons. Lbs.
Selected Leaming	24	19 1,110
Champion White Pearl	30	19 1,007
Longfellow	36	18 1,960
"	42	17 1,661

The highest average yield for eleven years is from sowing in rows 24 inches apart, but there is very little difference between this and 30 inches apart. In order to cultivate the corn properly, should cleaning the land be an object in view, it must be

sown at least 36 inches apart, and better work can usually be done when the rows are even wider apart. This is more particularly true when the larger kinds are grown.

EXPERIMENTS WITH FIELD ROOTS.

Field roots are not largely grown in Manitoba, but the acreage is gradually increasing from year to year. The long winter makes the use of some such feed as roots almost essential, if stock are to be kept in thrifty, growing condition. For young cattle and growing pigs they are particularly desirable.

All classes of roots produce abundantly here when given suitable conditions. Turnips will probably continue to be the most satisfactory, as they are not so easily injured in spring or fall by frost as are mangels or sugar beets. When saved without frost, mangels and sugar beets will keep better than turnips and are more relished by cattle and hogs.

The past season was too warm and dry for the best success with roots, and the crop was somewhat below the average. Two sowings of each variety were again made this year, the first sowing giving the better results.

Sowing on the flat was practised, as the land does not dry out to the same extent as when it is drilled up. The rows were 30 inches apart, and the young plants were thinned out to about 9 inches apart in the row.

EXPERIMENTS WITH TURNIPS.

Twelve varieties of turnips were sown on clay loam that had been in potatoes the previous year. The first sowing was made on May 5 and the second on May 19, both lots being pulled October 16. The yield per acre in each case was estimated from the product of two rows, each 66 feet long.

TURNIPS.—Test of Varieties.

Number of Plot.	Number of Variety.	Yield per Acre.							
		1st Plot.				2nd Plot.			
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.
1	Bangholm Selected	23	1,256	787	36	12	1,872	431	12
2	Hall's Westbury	23	992	783	12	17	1,376	589	36
3	Halewood's Bronze Top	21	504	708	24	16	1,009	550	..
4	Good Luck	20	392	673	12	12	24	400	24
5	Jumbo	19	1,860	664	20	12	552	409	12
6	Magnum Bonum	19	1,072	651	12	15	1,680	528	..
7	Mammoth Clyde	19	1,072	651	12	14	1,832	497	12
8	Carter's Elephant	19	544	642	24	13	928	448	48
9	Kangaroo	17	56	567	36	13	136	435	33
10	Perfection Swede	16	1,792	563	12	16	1,528	558	48
11	Skirving's	12	1,608	426	48	24	576	809	36
12	Hartley's Bronze	12	552	409	12	17	320	572	..

EXPERIMENTS WITH MANGELS.

Eleven varieties of mangels were sown under uniform conditions. The land was a clay loam that had been in potatoes the year previous.

The first sowing was made on May 13 and the second on May 27. Both lots were pulled September 29. The yield per acre in each case was estimated from the product of two rows, each 66 feet long.

MANGELS.—Test of Varieties.

No. of Plot.	Name of Variety.	Yield per Acre. 1st Plot. Tons.	Lbs.	Bush.	Lbs.	2nd Plot. Tons.	Lbs.	Bush.	Lbs.
1	Gate Post	35	1,280	1,188	..	17	1,904	598	24
2	Half Sugar White	31	1,096	1,051	36	33	264	1,104	24
3	Perfection Mammoth Long Red	25	1,480	858	..	24	576	809	36
4	Prize Mammoth Long Red	25	1,216	853	36	19	1,864	664	24
5	Giant Yellow Globe	24	840	814	..	16	208	536	04
6	Yellow Intermediate	23	728	778	48	14	512	475	12
7	Giant Sugar White	21	1,560	726	..	31	832	1,047	12
8	Giant Yellow Intermediate	19	1,072	651	12	20	392	673	12
9	Selected Yellow Globe	18	1,848	624	48	15	1,944	532	24
10	Crimson Champion	18	696	611	36	3	72	101	12
11	Mammoth Red Intermediate	13	400	440	..	13	1,720	462	..

EXPERIMENTS WITH CARROTS.

Five varieties of carrots were sown this year under uniform conditions. The land was a clay loam that had been in potatoes in 1908. The carrots were sown in rows 18 inches apart, and the plants thinned out to about four inches apart in the row.

The first sowing was made May 5 and the second May 19. Both lots were pulled October 16. The yield per acre in each case was estimated from the product of two rows, each 66 feet long.

CARROTS.—Test of Varieties.

No. of Plot.	Name of Variety.	Yield per Acre. 1st Plot. Tons.	Lbs.	Yield per Acre. 1st Plot. Bush.	Lbs.	Yield per Acre. 2nd Plot. Tons.	Lbs.	Yield per Acre. 2nd Plot. Bush.	Lbs.
1	Ontario Champion	22	1,320	755	20	17	320	572	..
2	Mammoth White Intermediate	20	40	667	20	15	360	506	..
3	White Belgian	19	280	638	..	13	400	440	..
4	Half-Long Chantenay	18	1,840	630	40	15	1,240	520	40
5	Improved Short White	15	1,240	520	40	17	760	579	20

EXPERIMENTS WITH SUGAR BEETS.

As there are no sugar factories in Manitoba, sugar beets are grown for stock feeding only. Being richer in sugar than are other roots, they are greatly relished by all kinds of stock, hogs being particularly partial to them.

Samples of the three varieties grown here were forwarded to Mr. Frank T. Shutt, Chemist of the Dominion Experimental Farms, for analysis and the results are given herewith.

The percentage of 'Sugar in Juice' is higher than usual. The beets were slightly withered after being pulled and this, no doubt, is partly the reason for such unusually high figures.

The first sowing was made May 13 and the second May 27. Both lots were pulled September 29. The yield per acre was estimated from the product of two rows, each 66 feet long.

Sugar Beets.—Test of Varieties.

YIELD PER ACRE.

No. of Plot.	Variety.	Yield per Acre. 1st Plot. Tons.	Lbs.	Bush.	Lbs.	2nd Plot. Tons.	Lbs.	Bush.	Lbs.	Sugar in Juice. p. c.	Solids in Juice.	Co-efficient of Purity.
1	Klein Wanzleben...	20	1,976	699	36	14	512	457	12	17·33	21·17	81·8
2	Vilmorin's Improved	19	1,330	655	36	14	248	470	48	17·89	22·37	79·9
3	French Very Rich...	13	1,192	453	12	9	1,272	321	12	21·27	24·76	85·3

EXPERIMENTS WITH POTATOES.

Potatoes were only a fair crop in this district in 1909, as the season was too dry. The land on the Experimental Farm, a clay loam, was in good condition and a good average yield was secured. Potato beetles made their appearance as usual but were controlled by the use of Paris green.

Twenty-four varieties were grown this year. They were planted on May 25, in rows three feet apart, with sets about a foot apart in the row. They were dug October 1. No rot was observed.

The yield per acre in each case was estimated from the product of two rows, each 66 feet long

Potatoes.—Test of Varieties.

No. of Plot.	Name of Variety.	Character of growth.	Average size.	Total yield per acre. Bush.	Lbs.	Yield per acre of marketable. Bush.	Lbs.	Yield per acre of unmarketable. Bush.	Lbs.	Form and colour.
1	Ashleaf Kidney.....	Rank.....	Very large......	476	40	443	40	33	..	Long, white.
2	American Wonder..	"	"	421	40	407	..	14	40	Long, round, white
3	Morgan Seedling....	Fair......	Large	419	50	390	30	29	20	" pink.
4	Manitoba Wonder ..	"	"	412	30	379	30	33	..	" red.
5	Early White Prize..	"	Small to medium	403	20	355	40	47	40	White, oval.
6	Money Maker	Rank	Medium........	401	30	374	..	27	30	Round, oval, white.
7	State of Maine.. ...	"	Large	392	20	348	20	44	..	" white.
8	Rochester Rose......	Fair	Small	366	40	304	20	62	20	Long, pink.
9	Holborn Abundance.	Very rank	Large	341	..	306	10	34	50	Round, white.
10	Irish Cobbler..	Fair.....	Small to medium	337	20	293	20	44	..	" "
11	Reeve's Rose..	"	Medium.... ..	331	50	306	10	25	40	Flat, light pink.
12	Late Puritan	Rank.....	Large	330	..	313	30	16	30	Long, white.
13	Dreer's Standard....	"	Medium........	315	20	286	..	29	20	Flattish, oval, white
14	Dooley..............	"	Large	311	40	275	..	36	40	Round, white.
15	Everett	Fair......	Medium........	308	..	271	20	36	40	Long, pink.
16	Carman No. 1.....	"	Large	308	.	271	20	36	40	Flat, white.
17	Gold Coin...........	Very rank	"	306	10	265	50	40	20	Round, white.
18	MacQueen....	Fair......	"	302	30	278	40	23	50	Long, round, white.
19	Collin's Seedling....	Rank.....	Small....... ..	293	20	232	50	60	30	Round, white.
20	Vick's Extra Early	"	Small to medium	291	30	242	..	49	30	Flat, pink.
21	Empire State	"	Medium.... ..	282	20	264	..	18	20	Long, white.
22	Henderson's Russet Seedling.........	Fair......	Small	275	..	183	20	91	40	Long.
23	Uncle Gideon's Quick Lunch	"	"	243	50	216	20	27	30	Round, light pink.
24	Dalmeny Beauty....	Weak	"	179	40	139	20	40	20	Oval, white.

Varieties for early use that can be recommended are Everett, Bovee, Early White Prize, and for general crop; Dreer's Standard, Uncle Sam, Carman No. 1. Money Maker and American Wonder.

EXPERIMENTS WITH GRASSES AND CLOVERS.

It is pleasing to note a greater interest being taken every year in the culture of grasses and clovers throughout Manitoba. This is partly accounted for by the growing scarcity of wild lands from which hay may be cut, but is largely due to the growing appreciation of the fact that the farm lands of this province are in need of different treatment to that which they received when they were in virgin condition. Even the best land that has been under cultivation for fifteen to twenty years, growing cereal crops mainly, shows the need of grasses and clovers to add root-fibre and humus.

The general interest in mixed farming is leading many to experiment on a small scale with different kinds of grasses and clovers. It is recognized that the cultivation of these crops becomes essential where a higher system of agriculture is practised, and a wise course is pursued in gradually becoming accustomed to growing them.

In view of the great interest in the growing of these crops in Manitoba at the present time, a summary of the results that have been secured on this Farm and in other parts of the west, is herewith presented.

Alfalfa.

Alfalfa has been on trial at the Experimental Farm for upwards of fifteen years and has been grown to a limited extent in other parts of Manitoba. During these trials, failures have been met with and difficulties encountered, but of late years very good success has been had. There has not been sufficient experimental work done throughout the province to warrant us in recommending every farmer to grow alfalfa extensively, but such excellent crops have been secured here and at other points in Manitoba that we are warranted in suggesting that every farmer give it a trial. If the excellent qualities of the plant as a forage crop were known, with the conditions necessary to its successful cultivation, it would undoubtedly be grown much more extensively.

Alfalfa requires a well-drained soil and will not thrive on land where water lies at any time of the year. Sandy loam with a porous subsoil is usually considered ideal but the nature of the surface soil is of comparatively little importance. The most essential requisite in soil is that the water level be not closer than three feet to the surface.

The preparation of the soil is also important. Land in good condition that has been cropped for several years is preferable to new land. One of the best preparations is a crop of potatoes or roots, or summer-fallow is quite suitable. The important features are, that the land be fairly clean and quite free from grass, and in at least a fair state of fertility. Good catches have beeu secured on stubble land ploughed either in the spring or fall and well top-worked, but potato land or summer-fallow is to be preferred.

Alfalfa, like all other legumes, is able to utilize the nitrogen of the air in its growth and to this is largely due its value as a soil renovator and as a fodder. This important function is performed through the medium of bacteria which find lodgment in the roots of the plants. Their presence is indicated by the formation of small nodules or excrescences on the roots about the size of a pin head. These frequently appear in bunches and are usually found on the younger parts of the roots. The absence of these nodules is an indication that the soil does not contain the bacteria. The alfalfa will live for the first season at least without these bacteria being present, but it lacks stamina and vigour and is apt to succumb during the first winter.

Our prairie soils sometimes have these bacteria present naturally, but otherwise it is necessary to inoculate. This can most readily be done by securing soil from a field where alfalfa has been growing successfully and scattering it over the land at the rate of from 100 to 200 pounds per acre. This may be done to advantage before sowing the seed, but it may, if necessary, be distributed after the alfalfa is growing as it will gradually be washed in with the rain.

It is not always necessary to inoculate the land but it is always advisable, as the chances of success are thereby increased. The Experimental Farm will furnish 100 pounds of inoculated soil free to farmers in Manitoba who apply for it. The applicant will have to pay the freight from Brandon.

Several strains of seed have been under trial but up to the present there has been very little difference in hardiness shown. Turkestan alfalfa is generally considered somewhat hardier than the common alfalfa but it is not always so. Grimm's alfalfa, a strain grown in Minnesota for some years, has been found somewhat hardier than any other strain tested at the Experimental Farm, Indian Head, Sask. A plot of Grimm's alfalfa, sown at Brandon in the spring of 1908, has given good returns and has not winter-killed but neither has any of the other strains sown at the same time.

The seed may be sown any time after the middle of May until the first of July. A nurse crop of grain should never be used in this climate, as alfalfa sown with a nurse crop has always been a failure. Ffteen to twenty pounds of seed per acre is sufficient.

For several years we have sown our alfalfa with the ordinary grain drill. The seed is mixed with about twice the quantity of coarsely chopped barley or wheat to regulate the feed. The seed can be sown at a uniform depth by this method and is much better covered than when sown broadcast.

The plants should be clipped once or twice during the first season. This keeps weeds from seeding and makes the young plants root better. The cuttings may be allowed to lie on the ground unless they are very heavy. The last clipping should not be later than August 15, as the alfalfa should go into the winter with a good top. The alfalfa should not on any account be pastured the first season, and, if pastured afterwards, should never be eaten closely.

Much of the value of alfalfa hay depends upon the curing. After it starts to bloom, the stalks rapidly become hard and woody and lose their feeding value. It should, therefore, be cut as soon as it commences to bloom, or, as it is sometimes said, when it is one-tenth in bloom. The most nutritious part of the plant is the leaves and, to save the leaves, the curing must be done in the cock. It should be raked into windrows soon after cutting and at once put into small cocks to cure. In this way, the leaves are all retained on the stalks and the hay has not lost any of its nourishing qualities. It is usually an advantage to upset the cocks an hour or two before stacking or drawing to the barn, to air the part that has been next the ground. Two cuttings are usually all that can be secured in Manitoba in a season. The last cutting should not be made later than the middle of August to enable the plants to make some growth before winter.

To those who contemplate growing alfalfa, I would suggest that it be tried first on a small scale, not more than one or two acres. When a small area becomes established, it will furnish soil to inoculate as much land as it is desired to sow.

Several different strains of alfalfa are growing at present on the Experimental Farm. These were sown in 1907 and 1908. There has been practically no winter-killing up to the present. The mixtures of alfalfa with rye grass and Timothy yield a crop of mixed hay at the first cutting and a crop of pure Alfalfa at the second cutting.

The following table gives the yield of cured hay per acre from the alfalfa plots in 1909. Most of the plots are of one-fifth of an acre each.

ALFALFA AND ALFALFA MIXTURES.

Name.	Date of sowing.	Yield per Acre.					
		1st cutting.		2nd cutting.		Total.	
		Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Alfalfa (Indian Head Seed).......	1907....... .	2	300	1	1,800	4	100
Alfalfa....	"	1	1,800	1	1,250	3	1,050
Grimm's Alfalfa................	1908...........	2	800	1	1,725	4	525
Turkestan "	"	2	350	1	1,450	3	1,800
Alfalfa and Timothy.	"	1	1,600	1	1,800	3	1,400
" and Western Rye grass.....	"	1	1,450	1	1,550	3	1,000

RED CLOVER.

Red Clover has been under trial on the Experimental Farm since 1895. In many of the earlier trials, the clover suffered severely from winter-killing, particularly when it was sown with a nurse crop. When sown without a nurse crop, the plants became much stronger by fall and there was less loss during the winter. The first success in sowing with a nurse crop of grain was in 1904. In this trial, half a bushel of barley per acre was sown as a nurse crop and this was cut green for hay and removed at once from the land. The clover made good growth and came through the winter safely. For several years past, excellent results have attended the growiug of Red Clover both with and without a nurse crop.

Unlike alfalfa, Red Clover is a short-lived plant. It usually lives for two years only but uuder favourable conditions, will sometimes persist longer. It is usually sown mixed with some grass such as Timothy and Western Rye Grass, and two crops of hay taken. The first crop will be mainly clover, the second mainly grass.

It is impossible to state definitely why Red Clover has succeeded so much better during the past three or four years than formerly. The seasons have not been particularly propitious nor has the culture been markedly different. It is probably largely due to the land becoming thoroughly inoculated with the bacteria that thrive on the clover roots. The bacteria are closely allied to those that live iu contact with the roots of alfalfa and the function they perform is similar. When they are not present, the plants lack in vigour and stamina. Occasional clover plants that have nodules on the roots will be found in a field which has not been inoculated, and when the majority of the plants are from three to six inches high those inoculated are from twelve to fifteen inches high and of a darker, richer green colour. The bacteria will gradually spread where they are present in a field but the safer and quicker plan is to inoculate the land at the time the seed is sown. This can most readily be done by the application of soil from a field where Red Clover has been grown successfully.

Various nurse crops have been tried and, up to the present, oats have been found most satisfactory. They should be sown not thicker than two bushels per acre and the clover and grass seed sown with the grass seeder attachment to the grain drill, or separately with a grass seed grower, and harrowed in.

In 1908, twelve acres was seeded down with a mixture of Red Clover, 8 lbs., aud timothy, 4 lbs., per acre, with oats and an excellent stand secured. This field produced about two and a half tons of hay per acre in 1909 and part of the second crop was cut for seed. About twenty acres was seeded to the same mixture in 1909 and, with the exception of two or three acres on light land, was a fairly good catch. The season was quite unfavourable, as we had practically no rain after July and the weather was very hot after the grain was removed.

With Red Clover, as with alfalfa, it is not advisable to pasture duriug the fall of the year it is sown, as it should have as much top as possible to go into the winter.

The value of clover hay depends largely on its being cut early and cured properly. It should be cut as soon as it is in full bloom or it otherwise becomes too woody. The curing should be done in cocks to save the leaves, the most valuable part of the hay.

The following table gives the yields of hay per acre of a number of different clovers, grasses and mixtures sown in 1907 and 1908. The plots were all one-fifth acre each:—

CLOVERS, GRASSES AND MIXTURES.

Name.	Year Sown.	Yield per Acre.	
		Tons.	Lbs.
Red Clover (*Trifolium pratense*)	1907		1,725
Alsike Clover " *hybridum*)	1907		1,825
Timothy (*Phleum pratense*)	1907		1,870
Western Rye Grass (*Agropyrum tenerum*)	1907	1	575
Western Rye Grass and Red Clover	1907	2	575
Timothy and Red Clover	1907	1	725
Timothy and Alsike	1907		1,000
Orchard Grass (*Dactylis glomerata*)	1908		850

The yield from the Red Clover is low, but it must be remembered that this is the second year in crop. In 1908, the crop from the Red Clover was 3 tons, 800 lbs. per acre.

The difference in yield between the Western Rye Grass and the mixture of Western Rye Grass and Red Clover is noteworthy. The two plots were separated by only a four-foot division and the land was similar in every respect. There was a distinctly darker green to the plot with the clover throughout the season and the yield was nearly double that of the rye grass alone. Not only was there more hay, but the hay was also of better quality and much easier handled. There was also a heavier aftermath.

Orchard grass came through the winter without any winter-killing. It is really a pasture grass so the yield of hay is light. There was an abundant aftermath.

Perennial Rye Grass (*Lolium perenne*) was also sown in 1908 and was a good stand in the fall but was completely killed out in the winter. The conditions were the same as for the other grasses.

SUMMARY OF CROPS, 1909.

	Bush.
Wheat—	
6 varieties, 47·54 acres	1,504
38 uniform test plots	92
	1,596
Oats—	
3 varieties, 53·73 acres	3,302
35 uniform test plots	135
	3,437
Barley—	
2 varieties, 28·58 acres	1,385
29 uniform test plots	112
	1.497

Peas—	Bush.
3 varieties, 12·46 acres	394
16 uniform test plots	28
	422
Spring Rye	18
Flax	8
Potatoes	127
Roots	1,866
	Tons.
Fodder Corn	120
Hay—	
Alfalfa	20
Red Clover and Timothy	25
Brome	17
Western Rye Grass	19
Wild Hay	33
	114

CATTLE.

There are at present representatives of two breeds of cattle on the Experimental Farm—Shorthorns and Ayrshires—and a number of grades for feeding experiments.

The cattle on hand at present are:—

Shorthorns—Three bulls and ten females.

Ayrshires—Four bulls and three females.

Grades—Two cows, three heifers and forty steers.

MILK RECORD FOR 1909-10.

Name.	Breed.	No. of days milking.	No. lbs. milk.
Snowball	Ayrshire	328	5,824
Jane	Shorthorn	268	4,423
Daisy	"	136	2,704
Rose	"	324	5,768
Blanche	Grade	276	4,095
Lily	Ayrshire	353	7,943
Buttercup	Grade	93	2,496

STEER FEEDING EXPERIMENTS.

The work that was started in the fall of 1907 in the feeding of steers outside as compared with in the stable has been continued. The cattle secured this year were not of such good quality as those fed a year ago and the results have not been as satisfactory. Smaller gains were made and, although a better price was secured, there was less profit from the feeding operations.

Forty head of steers rising three years, were bought at $3.25 per hundred, and the test commenced on Dec. 7, 1908. They weighed about 150 pounds per head lighter than those fed the year before, averaging only 968 lbs. and a number were of poor conformation. The steers were divided into three lots, four were fed loose in a box stall, sixteen were tied in the stable and twenty were fed outside. No artificial shelter was provided for those fed outside, but there was considerable natural shelter in the form of poplar and oak scrub and coulées. These provided a break for the wind.

The outside lot was fed oat straw for roughage during most of the period, with some hay during the last six weeks. Those in the loose box were fed exactly the same

as those outside. Those tied in the stable were fed silage, a few roots, straw and chopped grain, the same as the year before.

The grain ration was light to begin with, being four lbs. per day, one half bran and one half barley and oat chop. This amount of grain was gradually increased until by the first of April they were receiving twelve lbs. per day. This amount was continued until they were sold on May 10, 1909.

The following prices were charged for feed:—

	Per ton.
Grain	$20 00
Bran	18 00
Ground Flax	30 00
Straw	1 00
Prairie Hay	4 00
Alfalfa	6 00
Ensilage	2 00
Oat Sheaves	3 00

TEST OF FEEDING STEERS.

Results.	—
Outside.	
No. of steers in lot	20
First weight, gross	19,635 lbs.
" average	981¾ "
Finished weight, gross	22,020 "
" average	1,101 "
Total gain in 154 days	2,385 "
Average gain per steer	119 "
Daily gain per steer	·77 "
" " lot	15·4 "
Gross cost of feed	$379 04
Cost of 100 pounds gain	15 89
Cost of steers, 19,635 lbs. at 3¼c	638 14
Total cost to produce beef	1,017 18
Sold, 17,980 lbs. at 5c. less 5 per cent	854 05
" 4,040 " 4½c. less 5 per cent	172 71
Profit on lot	9 58
Net profit per steer	47
Average buying price per steer	31 90
" selling " "	51 33
" increase in value	19 43
Average cost of feed per steer	18 95
Amount of grain eaten by lot	23,980 lbs.
" straw "	52,000 "
" hay "	34,000 "
" alfalfa "	4,000 "
" ground flax eaten by lot	140 "
" bran eaten by lot	3,460 "
Inside (Tied).	
No. of steers in lot	16
First weight, gross	15,020 lbs.
" average	938 "
Finished weight, gross	17,975 "
" average	1,124½ "
Total gain in 154 days	2,955 "
Average gain per steer	184 "
Daily gain per steer	1·2 "
" lot	19·2 "
Gross cost of feed	$267 81
Cost of 100 lbs. gain	9 05
Cost of steers, 15,020 lbs. at 3¼ per cent.	488 15
Total cost to produce beef	755 96
Inside (Tied)—*Con.*	
Sold, 16,900 lbs. at 5c. less 5 per cent	802 75
" 1,075 lbs. at 4½c. less 5 per cent	45 99
Profit on lot	92 78
Net profit per steer	5 79
Average buying price per steer	30 51
" selling "	53 04
" increase in value	22 53
" cost of feed per steer	16 74
Amount of grain eaten by lot	16,112 lbs.
" straw "	23,408 "
" ensilage "	43,200 "
" roots "	17,088 "
" ground flax eaten by lot	224 "
" bran "	2,768 "
" oat sheaves "	6,240 "
Inside (Loose).	
No. of steers in lot	4
First weight, gross	4,070 lbs.
" average	1,017 "
Finished weight, gross	5,110 .
" average	1,277 "
Total gain in 154 days	1,040 "
Average gain per steer	260 "
Daily gain per steer	1·6 "
" lot	6·4 "
Gross cost of feed	$ 70 91
Cost of 100 lbs. gain	6 81
Cost of steers, 4,070 lbs. at 3¼c	132 27
Total cost to produce beef	203 18
Sold, 5,110 lbs. at 5c. less 5 per cent	242 75
Profit on lot	39 57
Net profit per steer	9 89
Average buying price per steer	33 07
" selling "	60 69
" increase in value per steer	27 62
Average cost of feed per steer	17 75
Amount of grain eaten by lot	4,724 lbs.
" straw "	4,800 "
" hay "	6,800 "
" ground flax eaten by lot	56 "
" bran "	764 "

Group of Cattle fed without shelter.

Group of Yaks, Experimental Farm, Brandon, Man.

The small gains are partly attributable to the cattle being poor feeders. Furthermore, small, immature cattle do not make as rapid gains as older cattle of the same type.

There is also to be considered the weather that those outside had to contend with. This affected their gains not so much through their being uncomfortable as by making it difficult for them to secure water. The only water available was in a coulée near their feeding place and the extremely severe weather rendered it impossible to keep the water open. Consequently, they had often to go without water if they were not at hand shortly after the ice was cut. This undoubtedly militated against their progress.

The outside lot was weighed periodically during the winter to determine when the greatest gains were made. The larger animals made fairly good gains throughout, but during the very severe weather in January and February some of the smaller cattle actually lost weight.

The average weights as determined from time to time were as follows:—

	Lbs.
December 16	$981\frac{3}{4}$
January 16	$986\frac{3}{4}$
February 13	988
March 10	1,010
March 24	1,071
April 7	1,095
May 10	1,101

In the figures given above, labour is not taken into consideration. Much more labour was involved with those fed inside than with the outside lot, so that, if a definite price were charged for labour, the showing would be more favourable to the outside lot.

In estimating the net profit per steer, a definite price of $1 per ton is placed on all the straw fed. Since straw is largely considered a waste product, the profit has also been figured without placing any value on the straw, the other feeds being valued at the same prices as before.

The following are the figures on the latter basis:—

	Profit per head.
Lot—outside	$ 1 77
Lot—inside (tied)	6 54
Lot—inside (loose)	10 49

Cattle feeding will not be largely followed unless a better price can be obtained for the grain by feeding it than by selling. To give a clearer idea of the price obtained in this case through feeding, it has been figured out by placing the values given above on the coarse fodders and valuing the bran at actual cost. We find that for the grain fed the following prices were secured:—

	Outside.	Inside (loose).	Inside (tied).
Per ton	20·78	36·73	31·51
Oats per bushel	·35	·62	·53
Barley per bushel	·49	·88	·75

The results for the two years this experiment has been under way have been so divergent that it has been deemed advisable to repeat it. Last year's experience has shown that a good water supply is essential and provision for this has been made by sinking a well and using a tank heater in the trough. This has been used with splendid success throughout the winter of 1909-10. Another change made this year was that of feeding a heavier meal ration earlier in the feeding period, the cattle

being put on full feed about the first of February. At the time of writing, the experiment is still under way and the results cannot be reported until next year.

SWINE.

The herd of swine on hand at present consists of 32 head, as follows:

Yorkshires—1 stock boar, 1 young boar and 6 females.

Berkshires—1 stock boar, 6 young boars and 10 females.

Tamworths—1 feeding pig.

Grades—7 feeding pigs.

These are kept for experimental feeding or for breeding. Several head of both sexes have been sold during the year for breeding purposes.

EXPERIMENT IN PASTURING PEAS.

An acre of brome sod was broken in the spring and sown to peas at the rate of 3 bushels per acre. When the peas were ripe, fifteen growing pigs were turned in and given about one-fifth of an acre at a time, a portable fence being used for hurdling. A record was kept of the weights when turned in and when taken off after all the peas had been eaten. No other grain was fed, but water was supplied to them freely.

Following are the results:—

Date turned on peas, Sept. 8, 1909.

Date when peas were finished, October 5, 1909.

Number of days on peas, 27.

Weight at start, 1,215 lbs.

Weight at finish, 1,538 lbs.

Gain in weight, 324 lbs.

Gain per day, 12 lbs.

Gain per pig per day, ·8 lbs.

Value of pork produced at 7 cts. per lb., $22.68.

PASTURES FOR PIGS.

Rape is used mainly as summer pasture for pigs and is found excellent for the purpose. It may be sown any time after the first of May, and at intervals during the summer. It will thrive on almost any soil, but the richer in plant food the soil is and the more thorough the cultivating, the better the results.

In Manitoba, where there is seldom much moisture to spare, rape should be sown on the level in rows about two feet apart. This permits it to be cultivated in the intervals. Four pounds of seed per acre is sufficient. It responds to cultivation with a rapid, vigorous growth and in from six to eight weeks is ready for use. It can be fed to best advantage by giving the pigs but a small area at a time and changing them to a new piece every ten days or two weeks. The rape grows up again after being eaten off if not pastured too closely and a comparatively small area may therefore be used continuously through the summer.

YAKS.

A herd of six yaks, which were presented to the Department of Agriculture by His Grace, the Duke of Bedford, was received here in July, 1909. The herd consisted of one aged bull, one yearling bull, two aged cows and two yearling heifers. They had been about four months on their way from England, including the time they were kept quarantined, and the two cows appeared to be somewhat the worse of the long confinement, but their condition improved when they were put on pasture.

The Yak (*Bos grunniens*) is a native of Thibet, a couutry of great altitude, intense cold and sparse vegetation. It is said to thrive on the rocky hillsides on a limited food supply and not to be inconvenienced by the cold or snow. Its coat is specially adapted to protect the animal against extreme cold, as it consists of a short woolly growth next the skin, and a longer, coarser hair, that on the throat, shoulders, belly and hams, being from six to ten iuches long. The tail is very bushy and covers the hocks. The coarse hair is used by the Thibetans to make strong cloth, while the finer wool is manufactured into shawls and soft carpets.

In its native country, the Yak is domesticated and is used much as we use the ordinary ox in this country. They are considerably smaller than our ordinary cattle but resemble them in build except that they have a hump like the bison. Some authorities say that the mature bulls weigh 1,000 to 1,200 pounds, with the females somewhat smaller, but those that we have weigh little more than half this much.

The nature and habits of the Yak suggested the idea that they might prove useful in the extreme northern parts of Canada where, on account of excessive cold and deep snow, ordinary cattle cannot range without winter protection and feed. The offer of the Yaks to the Department was made by the Duke of Bedford on the suggestion of the naturalist, Ernest Thompson-Seton, Esq.

A range of about thirty-five acres of rough land was set apart for the herd. There is considerable natural shelter in the form of oak and poplar bluffs, and a creek in one of the coulées furnishes water. On the approach of severe weather, a shed was built to provide shelter from the wind and a well was sunk to ensure a supply of water in the winter. During the fall, they did more or less browsing but, as soon as they were fed hay and straw, they made no further effort to find their own living. During most of the winter they were fed a few pounds of grain once daily.

In January, we were unfortuante in losing the aged bull from enteritis, and, in March, one of the cows died. This cow had been sick for some time before arriving here and never seemed to regain her vigour. The other animals are in good health.

HORSES.

The horses consist of nine heavy work horses and three lighter horses used for driving and light work about the Farm. They have continued in good health during the year.

POULTRY.

Two breeds of poultry are kept: Barred Plymouth Rocks and Buff Orpingtons. Fairly good success was had with hatching, forty chickens being raised. A number of the cockerels were sold for breeding purposes. The flock at present consists of:

Barred Plymouth Rocks—2 cockerels and 14 hens.

Buff Orpingtons—3 cockerels and 10 hens.

BEES.

Of the eleven hives put into winter quarters in the fall of 1908, ten came through the winter in good condition and were put on their summer stands on May 3. The average loss in weight per hive during the winter was twelve pounds.

The early part of the season was favourable and each colony threw a swarm. The honey flow was good during July and forty-five pounds per hive was secured, but after the first of August, when the dry, hot weather set in, the flow ceased almost entirely. Very little was gathered after this date and considerable feeding was doue in September. Fifteen hives were put into winter quarters in November, 1909.

THE VEGETABLE GARDEN.

On the whole, the season was favourable to the vegetable garden. The frost of $3\frac{1}{2}$ degrees on June 14 did practically no damage. A torrential rain on June 28, accompanied by a terrific thunderstorm, did considerable injury to currant bushes, nearly all the new growth being broken off or so damaged that it had to be pruned off later. On July 8, an excessively strong wind at a high temperature did considerable damage to the vegetation. The cabbage and cauliflower were twisted and broken, and a number completely destroyed. The squash vines were also badly bruised, but these subsequently recovered.

The extremely hot weather during August and September favoured the growth of the corn, tomatoes, squash and cucumbers, but the bulbous crops suffered correspondingly. The tomatoes were a particular success this year. The first ripe fruit was gathered August 5, and a continuous supply was forthcoming until late in September. A light frost on August 29 damaged tomatoes, squash and corn. The squash recovered somewhat and the green tomatoes ripened indoors, but the corn was permanently injured. It would undoubtedly have ripened but for this slight frost, as we had three weeks of fine fall weather before the next frost on September 21.

The land used as a vegetable garden had produced a crop of roots in 1908 and had been fall-ploughed and packed, after receiving an application of manure. Spring weather was very backward so that there was little actual work on the ground until about the first of May. The soil worked down readily into a fine tilth, and the Planet Junior drill was used where practicable for sowing the seed. The germination of the seed was, on the whole, satisfactory. As soon as the plants were visible in the rows, the Planet Junior, with the hoe attached, was frequently used, and this effectively kept the ground clear of weeds and in a fine tilth for the conservation of moisture.

The Pocket Gopher (*Geomys bursarius*) again attacked practically everything in the garden and wrought considerable havoc. This pest, which has been increasing from year to year, would undoubtedly have done much greater damage had not over forty of them been trapped and destroyed. The habits of this animal are quite different to those of the ordinary gopher, and considerable study and practice is necessary to determine the proper method to follow to control them.

It is underground in habit and burrows long tunnels from place to place. Little mounds of earth on the surface indicate the direction of the tunnels. The mounds are formed at the ends of branch tunnels leading from the main one, and consist of the soil that has been dug from the main burrow. When, during this burrowing, they encounter a row of peas, carrots, beets, potatoes or other vegetable, their course follows the row, they devour the roots, and, in the case of most vegetables, the plants are killed at once. With potatoes, the plant is seldom killed outright but most of the tubers are nibbled and more or less injured. They also appear to be very partial to alfalfa and other clovers, and frequently destroy many flowers in the flower beds.

In appearance they are shorter and heavier built than the ordinary gopher, darker in colour, and have very heavy shoulders and front paws. The most distinguishing feature is the two pouches, one at either side of the head in which they carry food for storing, when not wanted for immediate use.

The gardener, in trapping them last year, took the following course. The traps were set between two of the mounds. When the run is located, a space is dug out with the garden trowel large enough to enable the trap to be set and placed on a level with the bottom of the run. This should be done with as little damage as possible to the run, and the hole should then be carefully covered with a sod and fine earth to exclude the light, leaving room for the trap to spring. By following this method nearly fifty were trapped in and around the gardens during the summer.

PARSNIPS.

Two varieties of parsnips were sown on May 4—Manitoba Prize Intermediate and Hollow Crown. Owing to the extremely dry weather, neither of the varieties attained a marketable size.

CARROTS.

The carrots were sown on May 4, French Horn and Improved Nantes being the varieties. Germination was good in both cases and an average crop was produced of roots of good shape and quality. The Improved Nantes proved the superior variety, being a heavier yielder, the roots more uniform and of better quality.

TURNIPS.

The first sowing of White Milan turnips was not successful. A second sowing on May 26 germinated satisfactorily and produced turnips ready for use early in July. These were of good quality while quite young, but soon became coarse and strong in flavour.

ONIONS.

Two varieties of seed onions were sown on May 4; large Red Wethersfield and Paris Silverskin. Germination was good, but both varieties suffered heavily by a most determined attack of the onion maggot and, although frequent dustings of powdered hellebore were resorted to, it did not effectually arrest its progress. Shalots and Dutch Sets were planted on May 7. These were also attacked by the maggot, but did not suffer so severely as the onion grown from seed. Some extra good specimens of Danver's Yellow Globe were obtained from the Dutch Sets. In every variety, the onions which escaped the maggot were well up to the average size, and the prolonged dry weather in the fall enabled us to harvest them in splendid condition.

LETTUCE.

The first sowing of lettuce was made on May 8, followed by a succession of sowings at intervals of about ten days, the last being sown on June 22. The varieties were Wheeler's Tom Thumb, Cos Trianon, Neapolitan and All-the-Year-Round. Wheeler's Tom Thumb, although producing heads of smaller size than the other varieties, proved superior in texture and flavour and remained in head for a much longer period without going to seed than any of the other varieties. Cos Trianon produced large, sound heads of excellent quality. Neapolitan, although a lettuce of fairly good flavour, was inclined to be loose in the head and coarse in texture. All-the-Year-Round did not seem to thrive from the start and was decidedly soft and of poor quality.

RADISH.

Successive sowings were made from May 4 at intervals of about two weeks. Three varieties of summer radishes and one of the winter varieties were sown. These all germinated satisfactorily, but suffered very heavily from presistent attacks by a maggot which resembles the onion maggot in appearance and habits. The Long Black Spanish Winter Radish produced a very heavy crop, but was rendered unfit for use owing to the ravages of this pest.

Of the summer varieties, the Forcing Turnip Scarlet and Early Scarlet White-Tipped produced large crops of roots of good quality and flavour. The Olive Scarlet produced a heavy crop, but the roots lacked in quality, being coarse and of a strong flavour.

PEAS.

Four varieties of peas were sown this year, William Hurst and American Wonder on May 8. The first mentioned variety germinated weakly and was also damaged

by the pocket gopher and produced a very meagre crop. American Wonder produced a large crop of peas of splendid quality and flavour, fit for use on July 6. This sowing was followed by Nott's Excelsior on May 26; this pea proved to be of excellent quality and flavour, but the crop was considerably reduced by the dry weather. The next sowing of the same variety on June 10 also suffered from drought. Champion of England was reserved for late use and was sown on June 22. The germination was good, but, after a height of a few inches was reached, they seemed to be at a standstill for a long while owing, no doubt, to the lack of moisture. However, they benefited greatly by late rains and produced a fine crop of peas of splendid quality during September, a time when green peas were very much appreciated.

BEETS.

Egyptian Dark Red Flat and Nutting's Dwarf Improved were the two varieties grown this year. Germination was very good and both varieties yielded well up to the average in weight, but the roots were very large and, consequently, the texture was somewhat coarse.

BEANS.

Five varieties of beans were planted this year, one sowing on May 26 and a subsequent one on June 7. Germination was good in every case and green beans were ready in large quantities by July 20. The names of the varieties were as follows:—Fame of Vitry, Dwarf Extra Early, Dwarf Wax Every Day, Emperor of Russia and Dwarf Matchless. All of these ripened their seed, which was gathered in good condition.

TABLE CORN.

This season was particularly favourable for the production of table corn. Golden Bantam, the earliest and, in many ways, the best variety, was ready for use on August 14. The cobs of this variety are not so large as those of the other varieties grown, but the superior quality and flavour more than compensate for this deficiency. Early Fordhook and Seymour's Sweet Orange produced satisfactory results. Burpee's Earliest Catawba, a new sort, was a few days later than the two last-named varieties and the yield was very light for so favourable a season. The quality, however, was excellent. Dakota Sugar and Devitt's Earliest Sugar were also planted with seed that was saved here last year, but it failed to germinate.

SQUASH, PUMPKINS, MARROWS, ETC.

Very satisfactory results were obtained from these vegetables. Some exceptionally fine specimens of splendid quality were produced. The seeds were planted in hills in the garden on May 29. Of the varieties grown, the under-mentioned proved their superiority: Mammoth Whale and Hubbard Squash, Large Yellow Globe Pumpkin, and Long White Bush Marrow. The last-mentioned is to be particularly recommended for summer use, being ready ten days before other varieties, is very prolific, and being of a bush habit of growth, occupies a minimum of space in the garden.

CUCUMBERS.

Three varieties of outdoor or ridge cucumbers were planted in hills on May 29 with very satisfactory results. The names were as follows: Prolific, Cool and Crisp, and Chicago Pickling, all of which did remarkably well, producing a heavy and continuous yield.

CITRON.

Four hills of the preserving or red-seeded variety were planted on May 29. These produced a most satisfactory return, over eighty fine specimens being gathered, some of them weighing up to 7½ lbs. each.

CAULIFLOWER.

Two varieties of cauliflower were sown in boxes in hotbeds on April 20 and were planted out on June 5. A previous sowing was made on April 8, but, owing to some unexplainable cause, our propagating house became ignited and it and practically all our seeds for the season were destroyed. We then had to resort to hotbeds and this caused a delay in starting those vegetable seeds which it was necessary to propagate indoors.

The cauliflower plants made rapid growth for several weeks but with dry weather they suffered considerably. The cabbage worm also did considerable damage to this vegetable. The varieties grown were Earliest Dwarf Erfurt and Early Snowball.

CABBAGE.

Two varieties of early cabbage were sown in boxes in the hotbed on April 20—Early Paris Market and Early Jersey Wakefield. The first-named again proved its superiority, producing sounder and heavier heads ready for use ten days before the latter.

Fottler's Drumhead was grown for fall and winter use, the method of propagating being the same as with the early varieties. Good, shapely heads were produced of fair quality, weighing, on an average, five and a half pounds each.

Some splendid specimens of the Red Pickling cabbage were grown this year, some of the heads weighing up to 8 lbs. each.

Brussels Sprouts were started and grown under the same conditions as mentioned above, but, owing to lack of moisture when the sprouts should have been developing, they did not produce a crop.

Owing to the continued drought this season, all the cabbage family were more or less adversely affected. They also received some injury from the cabbage worm, but successive dustings of pyrethrum powder gave satisfactory results.

TOMATOES.

The season of 1909 was undoubtedly most favourable for tomato culture. Sixty per cent of an unusually heavy crop ripened on the plant but, owing to an unfortunate frost on August 29, it was necessary to gather the balance of the fruit, practically all of which ripened indoors in a few days.

Two strains of seed of the Earliana tomato were sown. The strain obtained through a seedsman was sown in the hotbed on April 10 and selected seed from the Central Farm at Ottawa on April 20. These were both planted out in the garden on June 5. Although the selected seed was sown ten days later than the other, it ripened its fruit quite as early, bore a heavier crop and was decidedly superior in every way, producing shapely, clean, smooth specimens of great size.

The importance of staking and pruning the tomato plant was illustrated to a very noticeable extent. The lateral or side shoots which grow at every junction of a leaf with the main stem were not allowed to grow, consequently the main stem, which was from time to time attached to the stake for support, obtained is maximum in size and strength and produced enormous bunches of large, shapely fruit. When four or five bunches of fruit had set, the top of the plant was cut off and the entire energy of the plant was thus directed to the production of fruit. Had the plant not been pruned, it would have grown a large quantity of unnecessary wood and robbed the fruit accordingly. Other advantages of staking and pruning are, that the plant is kept in an upright position whereby all the fruits received the maximum amount of sunshine; the fruit is also kept high and dry and always in a clean, attractive condition.

WONDERBERRY.

Some seed of this berry was sown in a hotbed on April 20 and planted in the garden on June 5. It made rapid growth of a rank, bushy character, and bore abundance of berries right up till late frosts. Although of the same family as the tomato, it is of a hardier nature, thriving and growing for weeks after the tomato vines were destroyed by frost. Large quantities of the berries ripened, and, when preserved, made a very acceptable fruit, the flavour resembling to some extent that of the Thimbleberry or Blackberry.

SWISS CHARD OR SPINACH BEET.

A small quantity of this little-known but useful vegetable was sown in the garden on May 26. Germination was good and growth very rapid, and it soon produced an abundance of succulent greens of good flavour which remained fit for use till late in the season.

CELERY.

Our first sowing of celery was, unfortunately, lost with the burning of the propagating house, but some later plants were obtained and planted out in prepared trenches on June 15. Considering the extremely dry season, these made good progress and a number of stalks of fair size and good quality were dug on October 19.

RHUBARB.

The rhubarb beds received a heavy top-dressing of barn-yard manure last fall, and produced an enormous crop of large stalks of splendid quality. Tottle's Improved is especially a very desirable variety. This produced rhubarb ready for use by the last week of May, and, later in the season, stalks weighing up to fifteen and sixteen ounces each, of good tender rhubarb, were gathered.

FRUITS.

PLUMS.

Although growth did not start so early this spring as in some years, the season was a very favourable one for plums, the abundant sunshine and absence of severe frost till late in the fall, enabling us to harvest ninety per cent of a fairly heavy crop, A pail of plums of a late bearing seedling of the Cheney plum was gathered in splendid condition at the unusually late date of October 7.

The Major plums, a selection of the Manitoba wild plum, are still the first by ten days to ripen fruit, being ready this year on August 20. Plum South Dakota No. 7, fruited for the first time, producing a few plums of good size and flavour, which ripened about the last of August. The fruit is larger than the native plum, and this variety promises to be very useful. A few Cheney plums also bore fruit, as well as several seedlings of the Cheney. Trees of the selected varieties of the native plum should, without doubt, be grown by every farmer in this province. They are hardy, require little attention, are heavy croppers, and will produce ripe fruit of very acceptable quality, in any ordinary season.

APPLES.

Our apple orchards have again suffered very seriously from blight. It was, however, not nearly so bad as last year and, as very few trees were attacked during the late summer, we may from now on have comparatively little trouble from it. Considering the large number of trees that were blighted, a fairly good crop of fruit was harvested.

The following varieties of standard apples fruited this year: Hibernal, Duchess, Repka Kislaga, and Sweet Russet. These varieties have withstood the climate satisfactorily for several years and have not been as subject to blight as many of the other varieties. A number of the cross-bred apples fruited again, many of them producing very heavy crops. The principal ones were Columbia, No. 179, No. 167, Tony, Elsa, and Northern Queen. Several seedlings also fruited, but only two or three were at all promising.

The vacancies in the orchards caused by the blight were filled with a number of varieties of the cross-breds.

CURRANTS.

The plantation of currants set out in the spring of 1908 made splendid progress. Although all the bushes are comparatively small, nearly every variety bore fruit this year. Owing to an extremely heavy fall of rain on June 28 (when three-quarters of an inch fell in half an hour) nearly the whole of this year's growth of wood was broken off or rendered useless, which has, of course, adversely affected the progress of the bushes this season.

The following table gives the yield from one bush of a number of the heaviest yielding varieties.

Black.			Red.			White.		
	Lbs.	Ozs.		Lbs.	Ozs.		Lbs.	Ozs.
Topsy	2	9	Cherry	4	0	Verrier's White	1	2
Saunders	1	12	La Conde	3	8	White Grape	1	0
Black Grape	1	4	Cumberland Red	2	10	Large White	.	15
Kerry	1	3	Pomona	2	10	White Kaiser	..	14
Kentish Hero	..	14	New Red Dutch	2	3	Climax	..	12
Ontario	..	14	North Star	2	2	Brandenberg	..	10
Ethel	..	13	Simcoe	1	14	White Pearl	..	7
Eagle	..	13	Prince Albert	1	6	White Cherry	..	7
Climax	..	12	Raby Castle	1	3	White Dutch	..	5
Dominion	..	12	La Fertile	..	13	Admirable	..	4

GOOSEBERRIES.

The three varieties, Companion, Rideau and Carman, survived the winter, but were frozen back to the snow line, consequently there was not much wood left for bearing fruit. A small quantity of fruit was gathered from Rideau.

The undermentioned varieties were received from Ottawa this spring and made fairly good progress: Pearl, Downing, Whitesmith and Smith's Improved.

RASPBERRIES.

Owing to the fact that a great number of the raspberries planted last year failed to grow, it was necessary to re-arrange the plantation and fill up the vacant places with new canes which were obtained from Ottawa. The names of the varieties planted this spring are as follows: Highland Hardy, Thompson's Early, Herbert, Phœnix, Percy, Brandywine, Sarah, Golden Queen.

Of the varieties planted in the spring of 1908, Golden Queen, Columbia and Ruby Red withstood the rigours of the climate best. The Columbia made extensive growth this year, but it is of a long, sprawling character and would appear to be very liable to sustain injury and become twisted and broken by the strong winds. There was no fruit worth recording produced by any of the varieties this season.

With the object in view of ascertaining which are the hardiest and most frost-resisting varieties of raspberries, none of the canes were protected or buried last fall.

STRAWBERRIES.

Ten varieties of strawberries were received from Ottawa this spring as follows: Splendid, Beder-wood, Pocomoke, Senator Dunlap, Crescent, Uncle Jim, Enhance, Tennessee Prolific, Clyde, Lovett. Considering the very dry season, these made splendid growth and were well established plants by the fall. A covering of strawy manure was applied early in November and we hope to report favourably on the results next year.

THE FLOWER GARDEN.

The flower gardens, both perennial and annual, were again a source of attraction and admiration. In the perennial garden we had a practically unbroken supply of bloom and colour from early spring, when the irises burst into their gorgeous blaze of varied colours, till late in October, when the frost blackened the flowers of the Pyrethrum which were in profusion even at that late date. The Pæony in its various colours and fresh rich-looking foliage is to be highly recommended. Amongst other hardy and suitable perennials are Campanula, Phlox, Sweet William, Columbine, Lychnis, Delphinium, Anemone (wind flower), Dahlias, Gypsophila, Yarrow, Speedwell, Flowering Heliotrope and American Bugbane (*Cimicifuga racemosa*).

A bed of mixed pansies, which were propagated last year, were protected in the fall by a covering of dry leaves. This was carefully removed in the spring when danger of severe frost was past. Scarcely any winter-killing resulted by this treatment, spring growth soon started and the diversity of colours and profusion of bloom, which continued till late in the summer, were very pleasing.

We were somewhat handicapped with our annuals by losing our propagating house by fire. This, unfortunately, happened two days after all the seeds were sown, thus the loss was doubled, inasmuch as we lost our season's supply of seeds in addition to the building. Although considerable delay was therefore unavoidable, we made a second sowing in hotbeds on April 20 and 22 with fairly satisfactory results. The plants were subsequently set out in the garden during the first week in June and, although they made splendid progress for six or eight weeks and produced a great display of bloom, the flowering period was considerably curtailed by the very dry season. The following flowers were started in the hotbeds: Stocks, Antirrhinum, Summer Chrysanthemum, Balsam, Petunia, Centaurea, Calliopsis, Ageratum, Asters, Gaillardia, Marigold, Phlox, Dianthus, Verbena, Zinnia, Scabiosa and Pansies.

Twenty-six varieties of sweet peas were planted, but the dry season had a very adverse effect. The growth was weak and the blooms produced were considerably below the average in size. The somewhat late date at which these were sown was partly accountable for the poor results.

A sowing of sweet peas was also made this fall on October 28, when fourteen varieties of seeds, saved here in 1908, were sown.

The annuals, which did not receive the benefit of the hotbed treatment, were sown from the 5th to the 8th of June. Germination was somewhat uneven and, owing to a very heavy downfall of rain on June 28, many of the small seedlings were either buried or washed out entirely.

Those that remained suffered considerably from drought for a long while, but revived after late rains and gave a fairly good display, although late in the season. The names of the flowers sown out-of-doors which flowered successfully were Portulaca, Abronia, Eschscholtzia, Candy Tuft, Godetia, Nicotiana, Bartonia, Everlasting Flower, Poppies in variety, and some of all the varieties that were started in the hotbeds.

DAHLIAS.

The dahlia roots came out of their winter storage in good condition. They were then placed in a cold frame and soon made vigorous growth, but, after removal to

the flower garden, they suffered considerably on account of the dry weather and did not produce the best results.

ROSES.

As in most previous cases, practically all the roses but the *Rosa rugosa* and the Yellow Persian rose, were killed back to the ground. These two varieties, however, stood the winter without any covering or protection and bore quite a quantity of good blooms. A few blooms were also obtained from *Rugosa alba* and New Century. The Crimson Rambler and Lady Helen Gould both made good growth but did not produce any bloom.

BULBS.

A consignment of bulbs of different kinds received from the Central Experimental Farm in the autumn were planted immediately on arrival. They consisted of Hyacinths, Tulips, Daffodils, Squills, Snowdrops, Crocus and Spanish Iris. The Hyacinths and Daffodils were planted in pots for house bloom during the winter and were very satisfactory. The Tulips gave a splendid display of bloom and were a source of much admiration.

The Crocus bulbs rotted in the ground and the Squills, Snowdrops and Spanish Iris, although not entirely winter-killed, did not produce bloom and therefore cannot be considered a success.

AGRICULTURAL MEETINGS.

During the year, a number of farmers' meetings have been attended, as much time as possible being devoted to this work during the winter.

In January, I acted as one of the grain judges at the Provincial Grain Show for Saskatchewan, held at Regina January 15, to 28, and addressed the Agricultural Societies' Convention on 'The Functions of an Agricultural Society.' Short talks were also given on 'Promising new Varieties of Wheat' and 'Alfalfa-growing.' At the Agricultural Societies' Grain Show, in Winnipeg, in February, I assisted in the judging of the grain and at the Short Course in Grain and Stock judging, took several of the classes in grain-judging. At the Manitoba Winter Fair and Fat Stock Show, in Brandon, March 5 to 11, I gave an address on 'Alfalfa-growing' and reviewed the results of some of our experiments in the feeding of steers. I also discussed our steer feeding experiments at the Fat Stock Show held in Regina March 22 to 25.

Seed fairs were attended at Cypress River, February 2; Reston, February 4, and Carberry, February 8, and a Farmers' Institute meeting at Holland on February 26 All of these meetings were well attended.

DISTRIBUTION OF SAMPLES.

The distribution of samples of grain, potatoes, trees, shrubs, &c., has been continued and, during the past year, the following material has been sent out:—

Wheat in 3-lb. bags	51
Oats in 3-lb. bags	48
Barley in 3-lb. bags	22
Peas in 3-lb. bags	17
Potatoes in 3-lb. bags	252
Total number of samples sent out	390

CORRESPONDENCE.

Since the last report, 3,006 letters have been received and 2,864 despatched, irrespective of circulars sent out.

METEOROLOGICAL RECORD FOR BRANDON.

Months.	Highest Temperature.		Lowest Temperature.		Total Rainfall.	Total Snowfall.	Hours Bright Sunshine.
1909.	Date.	Deg.	Date.	Deg.	Inches.	Inches.	Hours.
April	25	58·9	27	8·	·11	10	196·4
May	4	81·5	1	9·	2·53	....	231·0
June	29	88·5	14	28·	2 62	....	239·2
July	(1 & 30)	86·	3	39·	3·20	....	253·3
August	20	95·5	29	30·5	·38	....	298 4
September	11	90·	22	28·	1 03	....	242 7
October	6	84 5	27	0·	·37	·5	124 3
November	4	58·9	21	−22·2	·17	14	112·9
December	1	36·9	9	−45·4	....	27	49·2
1910.							
January	31	32 9	4	−38 3	....	2	119 9
February	28	39 9	22	−38·3	....	3	145·
March	23	78	9	0·	1·21	4	183·1
					11 62	*60·5	2,189·4

* Taking 10 inches of snowfall as equivalent to 1 inch of rainfall, the total precipitation for the year ending March 31, 1910 was 17·67 inches.

I have the honour to be, sir,

Your obedient servant.

JAMES MURRAY,

Superintendent.

EXPERIMENTAL FARM FOR SOUTHERN SASKATCHEWAN

REPORT OF ANGUS MACKAY, SUPERINTENDENT.

INDIAN HEAD, SASK., March 31, 1910.

Dr. WM. SAUNDERS, C.M.G.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit to you the twenty-second annual report of the Experimental Farm for Southern Saskatchewan, at Indian Head, for the year ending March 31, 1909.

The past season was, without exception, the most favourable for the growing of grain crops that the province has ever experienced.

A few districts suffered from too little moisture, others from too much, but all had good returns and many very good.

The winter of 1908-1909 was marked by the very cold weather of January, but was moderate during the rest of the winter. Very little snow fell.

Seeding was general from April 15 to 19, but snow and frost at the end of the month delayed the work.

In no previous spring did grain come up so evenly, or make better progress. No set-backs took place during the entire season.

Wheat in the Indian Head district, and in others with heavy soil, suffered in yield from too much rain and heat while the grain was ripening.

Harvest was general about August 25, and from that time until all grain in the province was in stook, the weather was unexcelled.

Threshing had equally favourable weather, and, except in new districts where machines were scarce, no delay took place, the work being finished long before cold weather set in.

CROPS ON THE EXPERIMENTAL FARM.

On the Experimental Farm, seeding started on April 17, barley harvest on August 13, and threshing on September 10.

Heavy rains between July 26 and August 9 (5·67 inches in all) lodged nearly all grain on the Farm, making it necessary to cut it one way, also causing much smaller yields than would otherwise have been obtained. Very hot weather followed each rain and wheat especially suffered, though oats and barley, being further advanced when lodged, were not injured to the same extent.

The hay crop was satisfactory, but incessant rains after cutting commenced made the curing difficult.

Roots gave good returns. Corn and potatoes were especially good, and were secured without loss. A heavy frost on October 13 injured turnips and mangels, and destroyed a great many potatoes throughout the province.

Vegetables of all sorts were abundant on the Farm and everywhere through the province. Tomatoes, which seldom ripen, did so without protection.

Fruits gave large crops. Trees and shrubs, starting very early in the spring, made good growth during the entire season owing to the rain and heat.

WHEAT EXPERIMENTS.

All varieties of wheat in plots and in fields gave promise of a record yield up to July 27, after which very heavy rains set in, and, with extremely hot weather, rust struck the straw. Wherever lodged, the grain was shrunken and the yield greatly reduced.

Spring Wheat—Test of Varieties.

Thirteen varieties of spring wheat were sown on April 27 or May 4. A heavy snow-storm delayed seeding after five plots had been sown. The land was a clay loam, fallowed the previous year. All sorts were more or less rusted, and all were badly lodged.

One variety of Durum wheat (Kubanka) was sown on May 4, under the same conditions as the sorts referred to above. All the plots were one-twentieth acre in size.

Spring Wheat.—Test of Varieties.

No. of Plot.	Name of Variety.	Date of Ripening.	No. of days Maturing.	Average length of Straw, including Head.	Character of Straw.	Average length of Head	Kind of Head.	Weight of Straw.	Yield per Acre		Weight per measured Bushel after Cleaning.
				Inches.		Inches.		Lbs.	B.	lbs.	Lbs.
1	Marquis..........	Aug. 22	117	46	Medium	3	Beardless	4,430	37	30	63
2	Huron Selected...	26	114	47	"	4½	Bearded	5,890	33	20	58¼
3	Preston	22	110	47	"	4	"	5,430	33	20	62
4	Stanley A........	23	111	48	"	3¼	Beardless	4,680	31	40	57¾
5	Riga.......... ..	20	108	46	"	3½	"	4,550	31	10	58½
6	Bishop	19	114	49	Weak	3	"	6.390	28	50	58¾
7	Bobs......	19	114	44	Strong	3¼	"	5,000	28	40	58
8	Pringle's Champlain..........	25	113	43	Medium	4	Bearded	4,080	27	..	58
9	Chelsea.	19	114	45	"	3½	Beardless	4,820	26	40	57
10	Red Fife H.......	28	123	44	Weak	3	"	4,950	24	50	58
11	Percy A	23	111	46	Medium	3½	"	3,540	24	40	55
12	White Fife..	28	116	52	"	4	"	4,450	23	50	55¼
13	Hungarian White.	28	116	47	"	4½	Bearded	4,730	23	10	58½
	Durum Wheat.										
	Kubanka.	Aug. 24	112	50	Weak	3	Bearded	3,520	34	20	63

TEST OF SPRING WHEAT IN FIELD LOTS.

Seven varieties were sown in field lots on fallowed clay loam between April 19 and 24, at the rate of 1½ bushels per acre. Like the grain in the plots, all were injured by the excessive rain and heat. The Stanley and Marquis varieties were slightly rusted, and Bobs and Chelsea badly so.

Spring Wheat.—Test of Varieties in Field Lots.

No. of Plot.	Name of Variety.	Size in Acres.	Date of Sowing.	Date of Ripening.	No. of days Maturing.	Average length of Straw, including Head.	Character of Straw.	Average length of Head.	Kind of Head.	Yield per Acre.	
						Inches.		Inches.		B.	L.
1	Huron Selected.	4·67	Apl. 24	Aug. 26	124	36	Strong	3¼	Bearded	36	..
2	Preston........	6·42	24	26	124	46	Medium	3½	"	31	50
3	Huron Selected......	3·25	24	26	124	40	Strong	4	"	30	10
4	Red Fife H	20·12	20	Sept. 1	134	45	"	3¼	Bald	28	45
5	Stanley A	5·03	22	Aug. 25	125	46	Medium	3¾	"	28	15
6	Red Fife H..........	5·59	23	Sept. 1	131	45	Strong	3½	"	26	35
7	Bobs....	3·46	23	Aug. 23	122	38	"	3	"	26	17
8	Marquis B...........	5·00	22	25	125	42	"	3¼	"	25	3
9	Red Fife (on Stubble).	4·21	19	24	127	45	"	3½	"	17	48
10	Chelsea..	4·94	20	24	126	41	"	3¼	"	14	54

Spring Wheat—Average and Total Yields.

Variety.	Cultivation.	Acres.	Yield per Acre.		Total Yield.	
			Bush.	Lbs.	Bush.	Lbs.
Huron Selected.......	Fallow............	4·67	36	0	168	7
Preston	"	6·42	31	50	204	22
Huron Selected..............	"	3·25	30	10	98	2
Red Fife H	"	20·12	28	45	578	27
Stanley A...............................	"	5·03	28	15	142	6
Red Fife H.....	"	5·59	26	35	148	42
Bobs.......	"	3·46	26	17	90	56
Marquis B...	"	5·00	25	3	125	15
Red Fife H..............................	Barley stubble .. .	4·21	17	48	74	56
Chelsea..........	Fallow....	4·94	14	54	73	36
		62·69			1,704	29

Average yield per acre: 27 bushels, 11 pounds.

FALL WHEAT.

Turkey Red fall wheat was sown on August 13, 21 and 31, and Kharkov on September 19, 1908. Until April 15 the grain looked promising, but frosts and thaws from then up to May 1 killed the crop, except in small patches sheltered by trees.

EXPERIMENTS WITH OATS.

TEST OF VARIETIES.

Twenty-three varieties of oats were sown in uniform plots on May 10 at the rate of about 2 bushels per acre. The soil was a clay loam, fallowed the previous season. All varieties were very heavy in straw with more or less rust, and were badly knocked down on July 27 by a heavy wind and rain storm (2·64 inches). Heavy rain on August 5 and 9 completely flattened all plots, and all had to be cut by mower. The plot of Banner suffered more than the others from lodging and gave, with one exception, the smallest yield, while in field lots it heads the list. The plots were each one-twentieth of an acre.

OATS—Test of Varieties.

No. of Plot.	Name of Variety.	Date of Ripening.		No. of days Maturing.	Average length of Straw, including Head	Character of Straw.	Average length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bush. after Cleaning.
					Inches.		Inches		Lbs.	Bush.	Lbs.	Lbs.
1	Pioneer	Aug.	25	107	46	Weak...	9	Branching	5,240	82	32	37¼
2	Virginia White	"	23	105	47	" ..	7	"	3,460	82	22	38
3	White Giant	"	23	105	49	" ..	9	"	5,460	82	22	37
4	Danish Island	"	25	107	48	" ..	8	"	4,400	81	06	40½
5	Thousand Dollar	"	22	104	51	" ..	9	"	5,500	81	06	38½
6	Twentieth Century	"	23	105	50	" ..	8	"	5,100	81	06	39½
7	Orloff	"	12	94	42	" ..	7	"	3,220	77	22	33
8	Siberian	"	23	105	44	" ..	8	"	3,040	77	02	40¾
9	Wide Awake	"	23	105	50	" ..	8	"	3,260	76	16	39
10	Alsasman	"	20	102	47	" ..	8	"	4,260	76	16	40
11	Abundance	"	23	105	45	" ..	9	"	5,680	76	6	40¼
12	Improved Ligowo	"	22	104	43	" ..	8	"	5,000	75	10	41
13	Kendal White	"	24	106	56	" ..	9	"	3,180	72	32	40½
14	'Regenerated' Abundance	"	24	106	50	" ..	9	"	3,780	72	32	35½
15	Swedish Select	"	20	102	50	" ..	8	"	3,860	70	30	40½
16	Lincoln	"	25	107	50	" ..	9	"	5,540	68	8	42½
17	Storm King	"	22	104	47	" ..	10	Sided ...	5,140	68	8	40
18	Irish Victor	"	26	108	46	" ..	9	Branching	5,180	67	2	40
19	Improved American	"	22	107	43	" ..	8	"	5,000	65	30	41½
20	American Triumph	"	23	105	48	" .	7	"	4,680	64	14	38¼
21	Milford White	e	25	107	48	" ..	9	Sided ...	4,520	63	8	42½
22	Banner	"	25	107	49	" ..	8	Branching	5,120	62	32	..
23	Golden Beauty	"	26	108	43	" .	8	"	4,800	60	20	37

TEST OF OATS IN FIELD LOTS.

Six varieties of oats were grown in field lots, on fallowed land, sown from May 5 to 8; two bushels of seed was sown per acre. All sorts were more or less lodged from the large crop of straw and heavy rains. Except a few acres of Banner, all had to be cut one way.

OATS—Test of Varieties in Field Lots.

No. of Plot.	Name of Variety.	Size of Lot.	Date of Sowing.		Date of Ripening.		No. of days Maturing.	Average length of Straw, including Head.	Character of Straw.	Average length of Head.	Kind of Head.	Yield per Acre.	
		Acres						In.		In.		Bush.	Lbs.
1	Banner	1 30	May	7.	Aug.	27.	112	49	Weak.....	8	Branching	94	27
2	White Giant	4 03	"	6.	"	26.	112	50	Medium..	8	" ..	94	17
3	Banner	12 93	"	5.	"	23	110	50	" ..	8	" ..	92	..
4	Danish Island	4.14	"	6.	"	25.	111	45	" ..	7	" ..	92	..
5	Abundance 'Regenerated'	3.64	"	7.	"	23.	108	50	Weak.....	8	" ..	89	3
6	Wide Awake	7.16	"	6.	"	24.	110	46	Medium. .	8	Sided.....	86	6
7	Banner	3 00	"	8	"	26.	110	50	" ..	8	Branching	85	25
8	Improved Ligowo	3.20	"	7.	"	24.	109	47	Strong....	7	" ..	70	28

Oats—Average and Total Yields.

Variety.	Cultivation.	Acres.	Yield per Acre.		Total Yield.	
			Bush.	Lbs.	Bush.	Lbs.
Banner	Fallow	1·30	94	27	123	8
White Giant	....	4·03	94	17	382	22
Banner	After Peas & Roots..	12·93	92	0	1,189	19
Danish Island	Fallow	4·14	92	0	380	30
Abundance 'Regenerated',	"	3·64	89	3	324	10
Wide Awake	"	7·16	86	6	617	0
Banner	"	3·00	85	25	257	7
Improved Ligowo	"	3·20	70	28	286	21
		39·40			3,501	15

Average yield per acre: 88 bushels, 30 pounds.

EXPERIMENTS WITH BARLEY.

All varieties in tests and in field lots were very heavy in straw and in all cases had to be cut one way. The grain was badly coloured on account of the heavy rains.

SIX-ROWED BARLEY.—TEST OF VARIETIES.

Eleven varieties of six-rowed barley were sown on the 10th of May at the rate of two bushels to the acre. The soil was a clay loam, fallowed the previous year, and all plots were one-twentieth of an acre in size.

SIX-ROWED BARLEY—Test of Varieties.

Number.	Name of Variety.	Date of Ripening.	No. of days Maturing.	Average length of Straw including Head.	Character of Straw.	Average length of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Inches.		In.	Lbs.	Bush.	Lbs.	Lbs.
1	Oderbruch	Aug. 14	96	32	Weak ..	$2\frac{3}{4}$	2,180	61	2	$52\frac{1}{4}$
2	Nugent	" 12	94	41	Medium..	$2\frac{1}{4}$	3,250	55	10	50
3	Mensury	" 12	94	37	" ..	$2\frac{3}{4}$	3,260	54	8	$49\frac{1}{2}$
4	Claude	" 12	94	38	" ..	$2\frac{1}{4}$	3,235	52	24	50
5	Odessa	" 14	96	37	" .	$2\frac{1}{3}$	2.820	52	24	$50\frac{3}{4}$
6	Trooper	" 11	93	42	" ..	$2\frac{3}{4}$	2,610	49	8	50
7	Mansfield	" 14	96	37	" ..	$2\frac{1}{8}$	2,500	48	36	51
8	Black	" 8	90	38	Weak ..	$1\frac{3}{4}$	2,580	48	36	.
9	Albert	" 12	94	37	Medium..	3	3,600	47	4	50
10	Yale	" 14	96	33	" ..	$2\frac{1}{2}$	3,680	46	12	51
11	Stella	" 11	93	38	" ..	3	2,650	45		$50\frac{1}{2}$

TWO-ROWED BARLEY.—TEST OF VARIETIES.

Ten varieties of two-rowed barley were sown on the 12th of May on clay loam, fallowed the previous season. All were badly lodged and the grain coloured by rain. Two bushels of seed were sown per acre, and all plots were one-twentieth of an acre in size.

TWO-ROWED BARLEY—Test of Varieties.

Number.	Name of Variety.	Date of Ripening.	No. of days Maturing.	Average length of Straw, including Head.	Character of Straw.	Average length of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Inches.		In.	Lbs.	Bush.	Lbs.	Lbs.
1	Gordon	Aug. 16	98	52	Strong....	2½	2,410	52	14	53½
2	Jarvis	" 19	101	49	Medium..	4	2,780	48	36	54
3	Canadian Thorpe	" 16	98	42	"	3	2,160	45	40	52½
4	Clifford	" 16	98	47	Weak....	3	2,400	45	40	53½
5	Invincible	" 19	101	44	Medium..	2½	3,930	45	20	53½
6	Danish Chevalier	" 19	101	53	"	4	2,640	41	32	51½
7	Swedish Chevalier	" 19	101	40	Weak....	4	2,240	40	30	—
8	Standwell	" 18	100	40	Medium..	3½	4,070	40	20	53¼
9	French Chevalier	" 19	101	56	"	4½	4,320	33	16	51
10	Beaver	" 17	99	34	"	4	3,620	32	44	51½

FIELD LOTS OF BARLEY.

Seven sorts of barley were sown in field lots on May 7 and 8, the land having been fallowed the previous year. All had to be cut one way. The grain was badly coloured, and, in most cases, a good deal shrunken. Two bushels of seed were sown per acre.

BARLEY—Test of Varieties in Field Lots.

Number.	Name of Variety.	Size.	Date of Ripening.	No. of days Maturing.	Average length of Straw, including Head.	Character of Straw.	Average length of Head.	Kind of Head.	Yield per Acre.	
		Acres.			Inches.		In.		Bush.	Lbs.
1	Claude	3 50	Aug. 13	97	40	Medium..	2½	6 rowed..	75	39
2	Mensury	13·91	" 13	97	39	"	2½	6 "	51	50
3	Canadian Thorpe	3 04	" 18	103	44	"	2½	2 "	45	30
4	Invincible	1·84	" 19	103	37	"	3¼	2 "	44	24
5	Standwell	3·29	" 19	104	38	"	3	2 "	40	25
6	Mansfield	2·64	" 13	97	39	"	2½	6 "	38	20
7	Sidney	1·97	" 14	99	43	"	4	2 "	35	0

BARLEY—Total and Average Yields.

Variety.	Cultivation.	Acres.	Yield per Acre.		Total Yield.	
			Bush.	Lbs.	Bush.	Lbs.
Claude	Fallowed..	3·50	75	39	265	16
Mensury	"	13·91	51	50	723	23
Canadian Thorpe	"	3·04	45	30	138	34
Invincible	"	1·84	44	24	81	32
Standwell	"	3·29	40	25	133	15
Mansfield	"	2·64	38	20	101	20
Sidney	"	1·97	35	0	68	45
		30·19			1,512	41

Average yield per acre, 50 bushels 4 pounds.

EXPERIMENTS WITH FIELD PEAS.

TEST OF VARIETIES.

Sixteen varieties of peas were sown on May 11 in one-twentieth acre uniform plots on clay loam on which roots had been grown the previous season. The land was ploughed when the roots were taken up. All varieties gave good yields. all ripened perfectly. and were good samples. The seed was sown at the rate of from 2 to 3 bushels per acre according to the size of the pea.

In this province, considerable risk is run of winds blowing the crop of peas over the farm if a storm arises after they are pulled, and before stacking or housing.

To overcome this risk, for several years it has been the practice to allow all varieties to become dead ripe; then harvest and stack at the same time. with a pea harvester attached to the mowing machine. A crop can thus be easily and quickly secured.

It is found that peas that have stood a week or ten days after getting ripe, do not shell any more than, if as much as, when pulled earlier.

Peas—Test of Varieties.

No. of Plot.	Name of Variety.	Date of Ripening.		Number of days Maturing.	Character of Growth.	Length of Straw.	Length of Pod.	Size of Pea.	Yield per Acre.		Weight per Bushel
						In.	In.		Bush.	Lbs.	Lbs.
1	Mackay..................	Aug.	30	111	Strong....	55	2½	Large ...	58	0	64¾
2	Prince............... ...	"	28	109	" ...	62	2½	Small. . ..	56	20	64½
3	Gregory............ ...	"	26	107	"	56	2¼	Medium. ...	54	40	64
4	English Grey.	"	28	109	"	60	2	Large	48	0	64
5	Arthur......	"	26	107	"	53	2¼	"	47	20	65
6	Paragon.	"	29	110	"	60	2½	Medium...	46	40	64¾
7	Picton.	"	30	111	"	58	2	"	46	40	64¾
8	Victoria...........	"	28	109	"	55	3	"	46	40	65
9	Chancellor.	"	26	107	"	58	2½	Small. .	45	40	64½
10	Prussian Blue........	"	28	109	"	57	3	Medium. ...	45	0	65
11	White Marrowfat. ..	"	30	111	"	63	3½	Large	45	0	63½
12	Black-eye Marrowfat......	"	30	111	"	65	3	"	43	40	64
13	Daniel O'Rourke..........	"	22	103	"	52	2	Small. .. .	42	20	64¾
14	Early Britain	"	30	111	"	56	3	"	42	20	62½
15	Golden Vine	"	25	106	"	48	1¾	"	39	0	66½
16	Wisconsin Blue...........	"	30	111	"	61	2½	"	34	0	65

PEAS IN FIELD LOTS.

Five varieties were sown in large plots, on clay loam in roots the previous year, and one of the five sorts was sown in addition on Western Rye Grass sod, ploughed just before sowing. As will be seen, the root land gave the better yield.

PEAS IN FIELD LOTS.

No. of Plot.	Name of Variety.	Cultivation.	Size of Plot.	Date of Sowing.	Date of Ripening.	Number of days Maturing.	Character of Growth.	Yield per Acre.	
			Acres.					Bush.	Lbs.
1	Arthur	After roots.	2·65	May 10.	Aug. 25..	107	Strong ...	60	9
2	Archer	"	0·45	" 10.	" 26..	108	"	56	40
3	Golden Vine	"	1·77	" 10.	" 25..	107	"	56	5
4	Golden Vine	W. rye sod..	1·16	" 14..	" 26..	104	"	50	53
5	Victoria	After roots	0·45	" 10..	" 28..	110	"	44	38
6	Gregory	"	0·20	" 10..	" 26..	108	"	43	45

SMUT TEST.

Red Fife Wheat was treated with bluestone and with formalin, and a plot was sown without being treated. No smutty heads were found in any of the three plots. On a two-acre field of Huron wheat there was considerable smut, while on a four-acre field of the same variety the crop was entirely free. None of the other wheats were affected.

Red Fife treated with 1 lb. bluestone in 10 gallons of water showed no smut and yielded 26 bushels per acre; Red Fife treated with 1 lb. formalin in 40 gallons of water showed no smut and yielded 22·20 bushels per acre; Red Fife, untreated, showed no smut and yielded 22·10 bush. per acre.

ROTATION OF CROPS.

These tests were commenced in 1899. Below will be found the order of rotation for the past three years, with yields, &c., of each plot in 1909. The plots are each one-half acre in size, the soil being clay loam. The preparation of the soil for the 1909 crop was ploughing 5 or 6 inches deep in the fall when the grain was removed, and cultivating shallow in the spring. In some cases a certain amount of rust was present.

ORDER OF ROTATION.

No.	1907.	1908.	1909.	No.	1907.	1908.	1909.
1	Peas	Wheat	Oats	12	Fallow	Wheat	Wheat
2	Tares	"	Wheat	13	"	"	Oats
3	Alsike	"	Oats	14	"	"	Barley
4	Red Clover	"	Wheat	15	Oats	"	Wheat
5	Alfalfa	"	Barley	16	"	"	Barley
6	Wheat	Peas	Wheat	17	Wheat	Oats	Red Clover
7	Oats	Tares	"	18	"	Emmer	Peas
8	"	Alsika	"	19	"	Oats	Tares
9	Wheat	Red Clover	"	20	"	Wheat	Alsike
10	Barley	Alfalfa	"	21	"	Barley	Alfalfa
11	Fallow	Wheat	"	22	"	"	Fallow

ROTATION TEST IN 1909.

Number.	Name of Variety.	Date of Sowing.	Date of Ripening.	No. of Days Maturing.	Average length of Straw, including Head.	Character of Straw.	Average Length of Head.	Yield per Acre.		Weight per measured Bushel after Cleaning.
					Inches.		Ins.	Bush.	Lbs.	Lbs.
1	Oats, Banner	April 26	Aug. 20	116	40	Strong	9	62	0	44½
2	Wheat, Red Fife	" 26	" 25	121	40	"	2½	14	40	55¾
3	Oats, Banner	" 26	" 20	116	43	"	8	42	26	42½
4	Wheat, Red Fife	" 26	" 25	121	36	"	3	11	8	58½
5	Barley, Mensury	" 26	" 13	109	38	"	3	26	6	0
6	Wheat, Red Fife	" 26	" 25	121	43	"	3¼	12	16	55
7	" "	" 26	" 25	121	41	"	3	14	24	56½
8	" "	" 26	" 25	121	40	"	3	13	32	57¾
9	" "	" 26	" 25	121	38	"	3	15	44	56¾
10	" "	" 26	" 25	121	39	"	3	16	44	55¾
11	" "	" 26	" 25	121	40	"	2½	15	22	0
12	" "	" 26	" 20	116	42	"	3	14	32	0
13	Oats, Banner	" 26	" 20	116	34	"	8	35	22	43½
14	Barley, Mensury	" 26	" 13	109	33	"	1¾	19	24	53
15	Wheat, Red Fife	" 26	" 25	121	37	"	2½	8	28	60
16	Barley, Mensury	" 16	" 13	109	32	"	2¼	18	28	52¾
17	Red Clover	May 25		Ploughed under August 11						
18	Peas	" 11		" July 29.						
19	Tares	" 11		" July 29.						
20	Alsike	" 25		" July 23.						
21	Alfalfa	" 24		" August 11.						
22	Fallow									

SUMMARY OF RESULTS OBTAINED FROM EXPERIMENTS IN CROP ROTATION AT INDIAN HEAD, 1899-1909.

As rotation work in connection with field crops at the Indian Head Farm is now being introduced on a much larger scale it is not thought necessary to continue experiments on the smaller plots, and the following summary of the results obtained on the latter has been made.

In 1899, eleven acres of summer-fallowed clay loam were blocked out in plots of ½ acre each and marked by permanent stakes at the corners.

The main object in view in this arrangement was to ascertain what advantage, if any, would arise from the use of leguminous plants for ploughing under every third year in place of the usual summer-fallow. The leguminous plants were to be turned under in each instance at the time they reached their heaviest growth.

The Red Clover was sown in the proportion of 12 pounds per acre and the mixed clovers in the proportion of 8 pounds of Alfalfa and 6 pounds of Alsike per acre. The Soja beans were sown in rows 14 inches apart, using 60 lbs. of seed per acre.

Plots 11, 12, 13, 14, give tests of grain growing with summer-fallow and 15 and 16 of growing a grain crop every year. The good results obtained from these two plots should not be taken as an argument in favour of continuous cropping. Such returns are only possible on comparatively new land and are obtained at the cost of the exhaustion of the fertility of the soil.

It will be seen that, in the course of these experiments, where the growing of grain has been continuous, the crop has on the average been reduced. Some exceptions to this will be found which may probably be accounted for by the more favourable character of the season.

ROTATION OF CROPS—Plan inaugurated in 1899 for a Rotation of Crops.

No.	1899.	1900.	1901.	1902.
1	Wheat	Oats	Soja Beans	Wheat
2	Wheat	Wheat	Peas	Wheat
3	Wheat	Oats	Tares	Wheat
4	Wheat	Wheat	Red Clover	Wheat
5	Wheat	Barley	Alsike and Lucerne	Wheat
6	Peas	Wheat	Wheat	Peas
7	Tares	Wheat	Oats	Tares
8	Soja Beans	Wheat	Oats	Soja Beans
9	Red Clover	Wheat	Wheat	Red Clover
10	Alsike and Lucerne	Wheat	Barley	Alsike and Lucerne
11	Rape	Wheat	Summer-fallow	Rape
12	Wheat	Wheat	Summer-fallow	Wheat
13	Wheat	Oats	Summer-fallow	Wheat
14	Wheat	Barley	Summer-fallow	Wheat
15	Wheat	Wheat	Oats	Wheat
16	Wheat	Barley	Oats	Wheat
17	Oats	Soja Beans	Wheat	Oats
18	Wheat	Peas	Wheat	Wheat
19	Oats	Tares	Wheat	Oats
20	Wheat	Red Clover	Wheat	Wheat
21	Barley	Alsike and Lucerne	Wheat	Barley
22	Rye	Summer-fallow	Wheat	Rye

The average and total yield of each variety of grain on each plot has been worked out for the number of years it has been sown and the revenue for each plot for the eleven-year period from 1899 to 1909 inclusive, found; wheat has been valued at 90 cents per bushel, oats at 40 cents, barley at 50 cents, rye at 75 cents and emmer at 1 cent per lb.

Any change made in the crops grown on a plot is noted in the table.

YIELDS PER ACRE.

No. of Plot	Variety.	1899.		1900.		1901.		1902.		1903.		1904.		1905.		1906.		1907		1908.		1909.	
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.
1	Wheat	36	6					25	0					33	20					31	16		
	Oats			11	2					47	12					55	30					62	
						Soja Beans.						Soja Beans.						Peas.					
2	Wheat	35	40	4	20			21	30	16	2			27	48	15	46			32	0	14	40
						Peas.						Peas.						Tares.					
3	Wheat	36	0					27	0					31	24					30	36		
	Oats			11	0					43	18					49	12					42	26
						Tares.						Tares.						Alsike.					
4	Wheat	35	46	5	0			27	15	15	30			28	32	19	4			29	50	11	8
						Red Clover.						Red Clover.						Red Clover.					
5	Wheat	35	40					20	45					28	54					31	40		
	Barley			9	44					20	40					25	2					26	6
						Clover.						Alsike.						Alfalfa.					
		Peas.						Peas.						Peas.						Peas.			
6	Wheat			16	50	38	52			21	8	31	28			21	36	17	31			12	16
		Tares.						Tares.						Tares.						Tares.			
7	Wheat			19	30					24	28					20	36					14	24
	Oats					97	32					70	24					62	6				
		Soja Beans.						Soja Beans.						Soja Beans.						Alsike.			
8	Wheat			18	20					22	58					19	14					13	32
	Oats					91	08					47	28					53	9				
		Red Clover.						Red Clover.						Red Clover.						Red Clover.			
9	Wheat			11	20	38	0			20	52	29	2			20	22	16	22			15	44
		Alsike.						Alsike.						Alsike.						Alfalfa.			
10	Wheat			8	20					23	14					21	46					16	41
	Barley					50	36					37	24					26	0				
		Rape.						Rape.						Timothy.									
11	Wheat			10	40					20	20					19	20			35	42	15	22
						Fallow.						Fallow.						Fallow.					

YIELD PER ACRE—*Continued.*

No. of Plot.	Variety.	1899.		1900.		1901.		1902.		1903.		1904.		1905.		1906		1907.		1908.		1909.	
		Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.
12	Wheat	36	6	7	40			18	45	14	16			34	10	18	16			36	32	14	32
						Fallow						Fallow						Fallow					
13	Wheat	35	36					22	30					38	52					31	40		
	Oats			9	14					42	12					34	4					35	22
						Fallow						Fallow						Fallow					
14	Wheat	35	40					20	50					32	54					31	10		
	Barley			4	32					18	36					15	24					19	24
						Fallow						Fallow						Fallow					
15	Wheat	36	0					27	15					32	46					14	36		
	Wheat			4	30					15	40					13	20					8	28
	Oats					80	26					82	14					52	12				
16	Wheat	35	20	9	4			22	45					18	24								
	Barley									20	0					18	10			14	6	18	28
	Oats					98	8					50	20					61	26				
17	Oats	85	0					31	16					42	12					46	4		
				Soja Beans.						Soja Beans.						Alsike.						Red Clover.	
	Wheat					43	44					39	12					18	10				
18	Wheat	36	16					25	0					18	26								
				Peas						Peas						Peas						Peas.	
	Wheat					43	18					36	8					15	56				
	Emmer																			1.284 lbs.			
19	Oats	86	24					32	26					52	18					52	2		
				Tares.						Tares						Tares.						Tares.	
	Wheat					43	2					36	0					12	56				
20	Wheat	36	0					27	0					23	28					Cut green			
				Clover						Clover						Clover						Alsike.	
	Wheat					42	16					32	6					23	18				
21	Barley	46	0					26	12					43	28					27	36		
				Clover						Alsike						Alfalfa.						Alfalfa.	
	Wheat					43	12					28	54					12	24				
22	Rye	41	0					25	0													Fallow.	
				Fallow.						Fallow.						Fallow.							
	Wheat					44	40					36	0					23	6				
	Emmer													1,866 lbs.									
	Barley																			22	20		

COMPARISON OF REVENUE FROM EACH PLOT.

Number.	Variety.	Average Yield per Acre.		Total Yield per Acre.		Total Revenue per Acre.	Total Revenue per Plot.	—
		Bush.	lbs.	Bush.	lbs.	$ cts.	$ cts.	
1	Wheat 4 years	31	24	125	36	113 04	91 78	
	Oats 4 years	44	3	176	10	70 52		
	Soja Beans 2 years } Peas 1 year }							Ploughed under.
2	Wheat 8 years	21	21	170	46	153 69	76 85	
	Peas 2 years } Tares 1 year }							Ploughed under.
3	Wheat 4 years	31	15	125	0	112 50	85 58	
	Oats 4 years	36	23	146	22	58 66		
	Tares 2 years } Alsike 1 year }							Ploughed under.
4	Wheat 8 years	21	31	172	5	154 88	77 44	
	Clover 3 "							Ploughed under.
5	Wheat 4 years	29	15	116	59	105 30	73 13	
	Barley 4 "	20	23	81	44	40 96		
	Clover 2 " } Alfalfa 1 " }							Ploughed under.
6	Wheat 7 years	23	15	162	44	146 46	73 23	
	Peas 4 years							Ploughed under.
7	Wheat 4 years	19	45	78	58	71 07	81 70	
	Oats 3 years	76	32	230	28	92 33		
	Tares 4 "							Ploughed under.
8	Wheat 4 years	18	31	74	4	66 66	71 80	
	Oats 3 years	64	4	192	11	76 93		
	Soja Beans 3 years } Alsike 1 year }							Ploughed under.
9	Wheat 7 years	21	40	151	42	136 53	68 27	
	Clover 4 "							Ploughed under.
10	Wheat 4 years	17	31	70	4	63 06	60 10	
	Barley 3 "	38	4	114	12	57 13		
	Alsike 3 " } Alfalfa 1 year }							Ploughed under.
11	Wheat 5 years	20	17	101	24	91 26	45 63	
	Rape 2 years } Timothy 1 year } Fallow 3 years }							Ploughed under.
12	Wheat 8 years	22	32	180	17	162 26	81 13	
	Fallow 3 "							Fallowed every third year.
13	Wheat 4 years	32	10	128	38	115 77	82 19	
	Oats 4 years	30	13	121	18	48 61		
	Fallow 3 years							Fallowed every third year.
14	Wheat 4 years	30	9	120	34	108 51	68 86	
	Barley 4 "	14	29	58	20	29 21		
	Fallow 3 "							Fallowed every third. year.
15	Wheat 4 years	27	39	110	37	99 56		
	" 4 "	10	30	41	58	37 77	111 77	
	Oats 3 years	71	29	215	18	86 21		

COMPARISONS OF REVENUE FROM EACH PLOT—*Continued.*

Number.	Variety.	Average Yield per Acre.		Total Yield per Acre.		Total Revenue per Acre.	Total Revenue per Plot.	—
		Bush.	lbs.	Bush.	lbs.	$ cts.	$ cts.	
16	Wheat 4 years	22	39	90	35	81 53		
	Barley 4 "	16	23	65	42	32 94	99 35	
	Oats 3 years	70	6	210	20	84 24		
17	Oats 4 years	51	8	204	32	81 98		
	Wheat 3 "	33	42	101	6	90 99	86 49	
	Soja Beans 2 years / Clover 2 years							Ploughed under.
18	Wheat 3 years	26	34	79	42	71 73		
	" 3 "	31	47	95	22	85 83	85 20	
	Emmer 1 year			..	1,284	12 84		
	Peas 4 years							Ploughed under.
19	Oats 4 years	56	1	224	2	89 61		
	Wheat 3 years	30	39	91	58	82 77	86 49	
	Tares 4 years							Ploughed under.
20	Wheat 3 years	28	49	86	28	77 82		
	" 3 "	32	33	97	40	87 90	82 86	
	Clover 4 "							Ploughed under.
21	Barley 4 years	35	43	143	28	71 80		
	Wheat 3 "	28	10	84	30	76 05	73 93	
	Clover 2 " / Alfalfa 2 "							Ploughed under.
22	Rye 2 years	33	0	66	..	49 50		
	Wheat 3 years	34	35	103	46	93 39	86 38	
	Emmer 1 year			..	1,866	18 66		
	Barley 1 "			22	20	11 21		
	Fallow 4 years							Fallowed every third year.

EXPERIMENTS WITH FLAX.

Five varieties of flax were sown on May 17 on fallowed clay loam in one-twentieth acre plots and two sorts on larger plots—one on fallowed land and the other on Western Rye sod ploughed before sowing.

The seed was sown by grain drill at the rate of 40 lbs. per acre.

A quantity of the Dutch flax was pulled by hand, tied up in sheaves, and sent to the Canadian Flax Mills, Toronto.

FLAX—Test of Varieties.

Number.	Name of Variety.	Size.	Date of Ripening.	No. of days Maturing.	Average length of Straw, including Head.	Character of Straw.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
		Acres.			In.		Lbs.	Bush.	Lbs.	Lbs.
1	Common		Aug. 31.	106	24	Strong	2,640	20	10	54½
2	White Flowering		" 24	99	26	"	3,280	18	32	55¾
3	Yellow Seeded		Sept. 3.	109	25	"	3,280	15	40	53¼
4	Riga		Aug. 28.	103	25	"	3,600	14	16	55
5	Improved Russian		" 27.	102	28	"	2,600	13	32	55
	Field Lots of Flax.									
	Dutch Flax (Fallow)	1·65	Aug. 24.	99	32	Strong	......	18	0	55
	Common Flax (W. Rye sod)	3·30	" 25.	100	30	Thin	......	10	32	

GRASSES AND CLOVERS.

The season was very favourable for all the varieties of grasses and clovers grown in 1909.

CLOVERS.

All strains of alfalfa tested and Red Clover did exceedingly well, with no spots injured from any cause whatever.

As alfalfa has now stood for five years and Red Clover for three years, there is reason to hope that, with care in seeding, and by not cutting or pasturing too late in the fall, both of these valuable clovers may prove quite hardy for all portions of Saskatchewan.

It has been found from previous tests that a great deal depends on the first season's growth as to whether the clovers prove hardy or not. If they enter the first winter with small, short roots, they are almost sure to succumb, while if the roots have taken a firm hold and are sufficiently deep to be below the freezing and thawing line in the early spring, they are reasonably safe. If, added to this, the precaution is taken not to pasture too closely or too late in the fall, there is no reason to doubt their entire success.

The course pursued on the Farm which has given the best success is to plough stubble land late in May 4 or 5 inches deep; then harrow once. After harrowing, 10 to 12 lbs. of seed per acre is sown with a wheelbarrow grass-seeder. When sown, the land is harrowed, rolled and again harrowed. The rolling firms the soil and leaves the surface in good condition for the mower, and the last harrowing prevents evaporation.

The seed is sown without a nurse crop, and when the plants are sufficiently high, the mower is run close to the ground to kill weeds and cause the roots to take a better hold. This is repeated up to the end of July, and, after that, all growth is left for winter protection.

It has been found, when a nurse crop has been grown, that the plants are weakly, even if not badly killed out, by the grain using up all the moisture in August. If they survive after the grain is harvested, as a rule the weather is too dry for them to make satisfactory root or top growth, and they are not in a condition to stand the thaws and frosts of April and early May.

I give the results of growing alfalfa since 1904. In 1904, 1905 and 1906 the clovers were more or less pastured late in the fall. Since then, the stock are not allowed on the clover for any length of time.

RESULTS OF EXPERIMENTS IN GROWING ALFALFA PRODUCED FROM SEED OBTAINED FROM DIFFERENT SOURCES, ON DOMINION EXPERIMENTAL FARM, INDIAN HEAD.

In the spring of 1904, two strains of Alfalfa, Turkestan and Utah, were obtained from the Department of Agriculture, Regina, Sask., and one strain (Common) from The Steele, Briggs Seed Co., Toronto. All were sown on May 30 in half-acre plots.

All made a strong growth during that season. The mower was run over the plots twice, to check weeds and strengthen the roots.

All came through the winter and spring of 1904-5, and were cut for hay on July 15 and September 5, giving yields as follows: Turkestan, 4 tons, 840 lbs.; Utah, 4 tons, 80 lbs.; Common, 3 tons, 1,122 lbs. per acre.

In the spring of 1906, Utah Alfalfa was completely killed. Turkestan and Common were considerably injured, and the first cutting of both sorts was light. They were cut July 11 and September 7, and yielded: Turkestan, 2 tons, 260 lbs.; Common, 1 ton, 666 lbs. per acre.

In 190[illegible], both plots were cut for hay on July 22, giving a yield of Turkestan, 1 ton, 1,163 lbs.; and of Common, 1 ton, 740 lbs. per acre. No second cutting was made, as the crop had been injured by the spring thawing and freezing, and in hopes of strengthening the roots, the second crop was left for protection.

In 1908, two cuttings were made, on July 4 and August 6, Turkestan giving 3 tons, 479 lbs.; and Common, 3 tons, 660 lbs. per acre.

In 1909, the cuttings were made on July 3 and August 18. In the first cutting, Turkestan yielded 1 ton, 1,270 lbs. of dry hay, and Common 1 ton, 980 lbs. per acre. The second cutting of both strains was put green into the silo for ensilage.

In 1905, the Department of Agriculture at Washington, D.C., sent nine strains of Alfalfa for testing. These were: Utah, Southern Montana, Commercial Seed, Minnesota (Grimm), Peru, New York, Samarkand (Turkestan), Nebraska and Northern Montana.

These were sown on May 18, on ½ or ¼-acre plots, the land having been fallowed the previous year. The mower was run over the plots twice, the clippings being left for winter protection. Late in the fall, cattle were pastured on the plots for a few days, as the growth was excessive.

RESULTS OBTAINED FROM THE VARIOUS STRAINS SINCE SEEDING.

Utah, Southern Montana, Commercial Seed, Peru and Northern Montana were entirely killed in the spring of 1906.

Minnesota (Grimm) came through perfectly and gave two cuttings in 1906.

New York, Samarkand and Nebraska were greatly injured, and the first cutting in 1906 was left on the ground.

The yields per acre for the four sorts have been:—

Minnesota (Grimm): 1906, 3 tons, 1,115 lbs.; 1907, cut for seed; 1908, 4 tons, 1,045 lbs.; 1909, 4 tons, 870 lbs.

New York: 1906, 2nd cutting, 1 ton, 1,523 lbs.; 1907, 3 tons; 1908, 4 tons, 1,832 lbs.; 1909, 1st cutting, 2 tons; 2nd crop put green into silo for ensilage.

Samarkand: 1906, 2nd cutting, 1 ton, 523 lbs.; 1907, 3 tons, 143 lbs. from 1st cutting, second growth left for protection; 1908, 4 tons, 654 lbs.; 1909, from 1st cutting, 1 ton, 1,910 lbs.; second crop put green into silo for ensilage.

Nebraska: 1906, 2nd cutting, 1 ton, 504 lbs.; 1907, 2 tons, 368 lbs. from 1st cutting, 2nd growth left for protection; 1908, 3 tons, 726 lbs.; 1909, 1 ton, 1,090 lbs. from 1st cutting, 2nd cutting put green into silo for ensilage.

STRAINS OF ALFALFA RECEIVED IN 1908.

In the spring of 1908, Grimm, Idaho, Montana, Dry Land and French Alfalfa were sent to the Experimental Farm for trial by Northrup, King & Co., Minneapolis, Minnesota. These, with some Turkestan Alfalfa from The Steele, Briggs Seed Co., Winnipeg, were sown on June 9, on fallow land. As in all other tests of alfalfa, the mower was used when the clovers were a few inches high, and the rest of the season's growth was allowed to remain for protection.

The yields per acre of the various strains for the season of 1909 were: Grimm, 2 tons, 1,398 lbs.; Idaho, 2 tons, 1,400 lbs.; Montana, 2 tons, 1,830 lbs.; Dry Land, 3 tons, 1,303 lbs.; French, 2 tons, 1,480 lbs.; Turkestan, 3 tons, 1,388 lbs.

STRAINS OF ALFALFA RECEIVED IN 1909.

In May last the following strains of Alfalfa were received from Mr. Chas. J. Brand, of the Department of Agriculture, Washington, D.C. They were sown on May 25, on well-prepared fallowed land.

18629. Canadian.
20896. Vilmorin's Commercial Sand Lucerne.
21217. Lecoq's Commercial Sand Lucerne.
21232. Mongolian.
21247. Canadian.
21867. Nephi, Utah (Dry Land).
21938. Grimm-Excelsior, Minnesota.
21945. Sextorp, Nebraska (Dry Land).
22467. Alt-deutsche fränkische.
22636. Provence-Aubignan, France.
22834. Wessel, Duval Peruvian.
22946. Baltic, S. D., Wheeler's Selections.
23203. Werny or Tschilik Alfalfa, Northern Turkestan.
23396. Commercial German Sand Lucerne.
23454. Chinook, Montana.
23481. Leifman's Commercial Bohemian Sand Lucerne.
24367. Arabia.
24451. *Medicago ruthenica* from Siberia.
24454. *Medicago falcata* from Siberia.
25115. Commercial Sand Lucerne from Bromberg, West Prussia.
25167. Hardy Thuringian Alfalfa, Erfurt, Germany.
25176. Commercial Bohemian Sand Lucerne, from Wissinger, Berlin.
25179. Hungarian Lucerne, Boschan, Vienna.
25257. Pfalzer Luzerne, from Bavarian Palatinate.
25269. Frasinet, Roumania.
25270. Vasluiu, Roumania.
25271. Ohio-grown Alfalfa, Belfontaine.

All germinated evenly, and made a thick, even stand, with exception of *Medicago ruthenica* and *Medicago falcata*, which attained a height of only a few inches by the end of the growing season. The growth of the others was very rapid, and, for fear of lodging, all were cut on August 2, the second growth being left for winter protection.

In 1909, a number of strains of alfalfa were also received from Dr. Saunders, Director of Experimental Farms, Ottawa. These had been sent him by J. W. Westgate, of the Department of Agriculture, Washington, D.C.

The strains are as follows:

23454 Montana.
25102 Grimm.
24836 Canadian (purple flowers).
24837 Canadian (variegated flowers).
23394 Sand Lucerne.
25022 Old Frankish Lucerne.
24452. *Medicago falcata.*

These were sown with the other strains received direct from Washington, on May 25, and did equally well. They also were cut on August 2.

GRASSES AND RED CLOVER.

The Brome Grass (½-acre) was sown in 1899, and has been left to ascertain how long it will give fair returns.

The yields each year since sowing are given of the 4½ acres of Western Rye Grass, to show the decrease in yield.

The Western Rye and Red Clover sown in 1906 was cut twice this year. The first crop was half-and-half, and the last was entirely clover, part being left until the seed ripened. 136 lbs. clover seed was obtained from 3 acres, the balance being used for hay. An ordinary threshing machine was used in threshing the clover.

The Red Top and Timothy was sown as pure Red Top, but proved to be greatly mixed.

English Blue Grass is a promising variety, especially for the large quantity of pasture it affords after the hay is cut.

YIELDS AND DATES OF CUTTING.

Variety.	Year sown.	Size.	Date cut in 1909	Yield per Acre.	Remarks.
		Acres.		Tons. Lbs.	
Brome Grass	1899	½	July 20.	1 1,040	Renewed by shallow ploughing in 1904.
Western Rye Grass and Red Clover	1906	7	" 9	2 100	1st. cutting.
" "		7	Oct. 2	1 1,000	2nd. cutting.
Red Top and Timothy	1908	½	July 6	2 250	
English Blue Grass	1908	½	" 6	2 960	
Red Clover	1908	½	" 6	1 1,463	1st. cutting.
"		½	Aug. 19	1 100	2nd. cutting.
Western Rye Grass	1906	4½	July 10	4 308	Yield in 1907.
" "	"	4½	" 16	2 1,536	" 1908.
" "	"	4½	" 7	1 1,925	" 1909.

INDIAN CORN.

Twenty-two varieties were grown, and all gave very satisfactory returns. The season was very warm, with abundance of rain, and with no frosts or set-backs of any sort. Several varieties were in the early milk stage when cut, which has only occurred once in previous years.

The land, a clay loam, was fallowed the preceding year, and 10 or 12 loads per acre of well-rotted manure applied after frost set in in November. Before sowing the corn, this was ploughed in, and well harrowed.

The corn was sown by grain drill on May 20 in rows 35 inches apart. The crop was cut on September 9, allowed to wilt on the ground two days, then drawn in, cut up and put into the silo. The yields were computed from the weight of 2 rows, each 66 feet long, after corn had wilted two days.

As will be seen, one variety—Patterson No. 1—was glazed when cut. This, without exception, was the earliest field corn ever grown on the Experimental Farm. Samples of this corn and of Patterson No. 2 were received for trial from the Manitoba *Free Press*.

Indian Corn—Test of Varieties.

Number.	Name of Variety.	Height.	Condition when Cut.	Weight per acre grown in Rows.		Weight per acre grown in Hills.	
		Inches.		Tons.	Lbs.	Tons.	Lbs.
1	Eureka	114	Tasselled	20	1,140	16	120
2	Superior Fodder	108	"	19	1,820	19	610
3	Early Mastodon	111	In silk	19	1,600	14	1,920
4	Mercer	96	Early milk	19	1,160	..	....
5	North Dakota White	102	"	19	170	19	830
6	Longfellow	108	In silk	18	1,400	19	390
7	Wood's Northern Dent	111	"	18	410	18	190
8	Compton's Early	102	"	17	1,970	20	700
9	Angel of Midnight	96	"	17	1,310	19	390
10	North Dakota White (2)	96	"	17	1,200	..	....
11	North Western Dent	96	Early milk	17	1,090	..	....
12	Selected Leaming	111	In silk	17	540	16	1,110
13	Triumph	96	Early milk	17	540	..	....
14	Salzer's All Gold	114	Tasselled	16	1,5 0	17	210
15	Mammoth Cuban	96	In silk	16	1,440	16	890
16	Davidson	84	Early milk	16	1,330	..	....
17	Champion White Pearl	102	Tasselled	16	560	16	1,660
18	White Cap Yellow Dent	102	In silk	16	450	14	1,810
19	North Dakota Red	102	Early milk	14	1,260	..	....
20	Patterson No. 2	75	Late milk	13	730	..	....
21	Patterson No. 1	75	Glazed	12	420	..	....
22	North Dakota Yellow	87	Early milk	12	310	..	....

EXPERIMENTS WITH TURNIPS.

Twelve sorts of turnips were tested on fallowed clay loam, manured and prepared in the same manner as that on which the corn was sown. The drills were 30 inches apart, aud the seed was sown on the flat.

All varieties were sown twice, and it will be seen that the early seeding gave the larger yield in all but four sorts.

A severe frost on September 13 froze the roots solid. They were drawn into the root cellar, and at this date (March 31) are being fed to the stock, but are not in as good condition as in other years.

The yields are computed from the weight of two rows, each 66 feet long.

TURNIPS—Test of Varieties.

Number.	Name of Variety.	1st Plot sown.	2nd Plot sown.	1st Plot pulled.	2nd Plot pulled.	Yield per Acre. — 1st Plot.		Yield per Acre. — 1st Plot.		Yield per Acre. — 2nd Plot.		Yield per Acre. — 2nd Plot.	
						Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.
1	Hartley's Bronze.....	May 15	May 26	Oct. 14	Oct. 14	30	852	1,014	12	28	1,420	957	00
2	Good Luck........ ..	" 15	" 26	" 14	" 14	29	344	972	24	25	1,216	853	36
3	Bangholm Selected.	" 15	" 26	" 14	" 14	27	1,044	917	24	24	1,632	827	12
4	Mammoth Clyde......	" 15	" 26	" 14	" 14	26	1,988	899	48	27	1,176	919	36
5	Halewood's Bronze Top....	" 15	" 26	" 14	" 14	26	404	873	24	25	952	849	12
6	Kangaroo	" 15	" 26	" 14	" 14	25	1,744	862	24	21	1,164	719	24
7	Magnum Bonum......	" 15	" 26	" 14	" 14	25	952	849	12	26	800	880	00
8	Jumbo	" 15	" 26	" 14	" 14	25	952	849	12	23	332	772	12
9	Carter's Elephant. . .	" 15	" 26	" 14	" 14	25	292	838	12	17	1,508	591	48
10	Hall's Westbury......	" 15	" 26	" 14	" 14	24	1,500	825	00	27	516	908	36
11	Skirving's	" 15	" 26	" 14	" 14	22	484	741	24	23	860	791	00
12	Perfection	" 15	" 26	" 14	" 14	20	1,844	697	24	19	808	646	48

EXPERIMENTS WITH MANGELS.

Ten varieties of mangels were sown on the same dates on a clay loam soil prepared in the same way as the turnip ground. The first seeding was destroyed as it came up by the Turnip fly, and was resown on June 14. The yields were computed from the product of two rows, each 66 feet long. The roots were pulled October 15.

MANGELS—Test of Varieties.

Number.	Name of Variety.	Yield per Acre. — 1st Plot.		Yield per Acre. — 1st Plot.		Yield per Acre. — 2nd Plot.		Yield per Acre. — 2nd Plot.	
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.
1	Giant Yellow Globe...	13	1,776	1,029	36	24	1,368	822	48
2	Half Sugar White.......	27	1,572	926	12	22	220	737	00
3	Giant Yellow Intermediate.....................	26	1,856	897	36	21	1 032	717	12
4	Prize Mammoth Long Red	25	1,876	864	36	21	1,560	726	00
5	Yellow Intermediate	24	1,500	825	00	23	1,256	787	36
6	Mammoth Red Intermediate	25	728	778	48	18	1,752	629	12
7	Selected Yellow Globe..	22	1,804	763	24	19	676	644	36
8	Perfection Mammoth Long Red....	22	616	743	36	21	504	708	24
9	Gate Post	21	1,296	721	36	11	1,892	398	12
10	Crimson Champion	17	1,772	596	12	15	1,284	521	24

FIELD CARROTS.

Five varieties were tested on fallowed clay loam, manured and prepared the same as for the other roots. The yield was computed in the same way. Only one sowing was made on May 14 and the roots were pulled October 15.

CARROTS—Test of Varieties.

Number.	Name of Variety.	Yield per Acre. — 1st Plot.		Yield per Acre. — 1st Plot.	
		Tons.	Lbs.	Bush.	Lbs.
1	Ontario Champion	21	372	706	12
2	Mammoth White Intermediate	16	1,132	552	12
3	Half-Long Chantenay	14	1,040	484	
4	White Belgian	14	380	473	
5	Improved Short White	12	1,872	431	12

SUGAR BEETS.

Three varieties of sugar beets were sown on clay loam, two sowings being made of each variety, the first on May 26 and the second on June 14. They were grown more to ascertain their sugar-content than for their feeding qualities. The yields were computed as for the other roots. From the analysis made by Mr. F. T. Shutt, Chemist of the Experimental Farms, the sugar-content was about the average. The roots were all pulled October 15.

SUGAR BEETS—Test of Varieties.

Name of Variety.	Yield per Acre. — 1st Plot.		Yield per Acre. — 1st Plot.		Yield per Acre. — 2nd Plot.		Yield per Acre. — 2nd Plot.		Per cent Sugar in Juice.	Per cent Solids in Juice.	Co-efficient of Purity.
	Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.	%	%	%
Klein Wanzleben	15	624	510	24	12	288	404	48	16·94	19·69	86.0
Vilmorin's Improved	14	248	470	48	11	1,100	385	00	17·25	19·89	86.7
French Very Rich	13	1,588	459	48	12	1,212	420	12	17·28	20·03	85.1

POTATOES.

The yield and quality of the potato crop in 1909 has never been surpassed on the Experimental Farm, and the yield throughout the province has never been approached. Unfortunately, large quantities were destroyed by the frost on September 13.

All the potatoes on the Experimental Farm were safely secured.

The yield per acre was computed from the weight of 2 rows, each 66 feet long, and 30 inches apart.

The tubers before planting were soaked for 2 hours in a solution of 1 lb. Formalin in 30 gallons of water. When dry, they were cut into sets with two eyes in each, planted on May 15, and dug on September 21.

The land was a clay loam fallowed, manured and prepared as for the other roots.

There was no injury from rot in any of the plots and the tubers were almost uniformly large.

POTATOES—Test of Varieties.

Number.	Name of Variety.	Total Yield per Acre.		Form and Colour.	Number.	Name of Variety.	Total Yield per Acre.		Form and Colour.
		Bush.	Lbs.				Bush.	Lbs.	
1	American Wonder...	686	24	Long, white.	11	Vermont Gold Coin.	506		Oval, white.
2	Everett	649	00	" pink.	12	Rochester Rose.....	503	48	" red.
3	Dreer's Standard....	611	36	Oval, white.	13	State of Maine.....	499	24	" white.
4	Vick's Extra Early..	611	36	" pink.	14	Dalmeny Beauty ...	497	12	" "
5	Irish Cobbler.. ..	611	36	Long, pink.	15	Money Maker	486	12	Long, white.
6	Morgan Seedling....	609	24	" "	16	Carman No. 1..	473		Oval, white.
7	Late Puritan... ...	602	48	Oval, white.	17	Ashleaf Kidney.....	464		Round, white.
8	Reeves' Rose........	583	00	" red.	18	Dooley............	369	36	Oval, white.
9	Holborn Abundance.	550	00	Round, white.	19	Uncle Gideon's Quick Lunch......	350		" "
10	Empire State.	534	36	" "					

SUMMARY OF CROPS.

Wheat—

	Bushels.
7 varieties in field lots, 62·69 acres..	1,704·29
10 half-acre rotation test plots..	68·25
14 uniform test plots..	20
	1,792·54

Oats—

	Bushels.
6 varieties in field lots, 39·40 acres..	3,501·15
3 half-acre rotation test plots..	70·7
23 uniform test plots..	84·12
	3,655·97

Barley—

	Bushels.
7 varieties in field lots, 30·19 acres..	1,512·41
3 half-acre rotation test plots..	32·41
21 uniform test plots..	49·17
	1,593·99

Peas—

	Bushels.
4 varieties in field lots, 6·68 acres..	373·15
21 uniform test plots..	37·4
	410·55

	Bushels.
Flax..	35
Fall Rye..	24
Potatoes..	200
Roots..	3,000

	Tons.
Corn Ensilage	60
Hay—	
	Tons.
Western Rye Grass and Red Clover	15
Western Rye Grass	21
Alfalfa	12
Other cultivated grasses	4½
Cut in coulées	20
	72½

VEGETABLES.

In no previous year were vegetables so abundant and of such good quality as last year over the whole province. On the Experimental Farm, all varieties sown gave large yields.

Beans and Tomatoes, which very often suffer from early frost, matured without injury from any cause.

ASPARAGUS.

In use from May 28 to July 20. A good crop was obtained from the old beds of Barr's Mammoth, Barr's Elmira and Conover's Colossal.

BEANS—Sown May 19 and 20.

Variety.	In use.	Pulled.	Remarks.
Haricot Matchless	July 28	Sept. 6	Long green.
Black Speckled	Aug. 3	" 6	"
White Field	" 5	" 2	Small green.
French Unrivalled	July 28	" 3	
Early Six Weeks	" 25	" 7	Long green.
Black Butter XXX	" 28	" 2	
Emperor of Russia	" 27	" 4	Short green.
Dwarf Wax	" 26	" 4	Long wax.
French Extra Early	" 25	" 3	Medium wax.
Haricot Extra Early	" 26	" 7	Long wax.
Dwarf Kidney	" 26	" 4	
Haricot Matchless	" 26	" 10	Rusted slightly.
French Dwarf Extra Early	" 25	" 2	
Dwarf Wax	" 26	" 8	"
Emperor of Russia	" 25	" 9	
Fame of Vitry	Aug. 2	" 10	
Challenge Black	July 25	" 4	"
Extra Early	" 25	" 1	
Honey Pod	" 25	" 9	Rusted.
Bush Green Pod	" 25	" 9	
White Field	Aug. 9	" 7	

BEETS—Sown May 14; Pulled October 14.

Variety.	In Use.	Yield per Acre.
		Bush.
Half Blood Red	July 14	1,033
Egyptian Dark Red	" 14	850
Nutting's Dwarf Improved	" 14	716
Detroit Dark Red	" 17	666

CABBAGE.

Variety.	In use.	Average weight.
		Lbs.
Early Cabbage—Sown in hot-house April 3. Set out May 19.		
Early Midsummer	July 15	6
Early Paris Market	" 1	7
Early Jersey Wakefield	" 18	6
Paris Market	" 6	6
Late Cabbage—Sown in hot-house April 3. Set out May 22. Pulled Oct. 14.		
Large Red Drumhead	Aug. 10	19
Kildonan	" 17	17
Volga or Russian	" 6	17
Brill's Nonsuch	" 6	16
Early Long Island	" 7	16
Fottler's Improved Brunswick	" 4	17
World Beater	" 12	17
All Seasons	" 15	16
Chester King	" 19	15
Autumn	" 20	20
Late Cabbage. 2nd Seeding. Sown in hot-house April 12. Set out May 26.		
Large Red Drumhead	" 25	17
World Beater	" 15	19
All Seasons	" 21	14
Kildonan	" 21	16
Volga	" 21	16

CAULIFLOWER—Sown in hot-house April 3; set out May 19.

Variety.	In use.	Average weight.
		Lbs.
Earliest Snowball	July 14	6
Henderson's	" 14	6
Selected Earliest	" 3	7
Early Snowball (C.E.F.)	" 3	8
Extra Early Whitehead	" 3	8

CARROTS—Sown May 10; taken up October 9.

Variety.	In use.	Yield per acre.
		Bush.
Chantenay	July 23	716
Half-long Danvers (North Dakota)	" 29	650
Half-long Danvers (from Canadian Seedsman)	" 21	633
Ox Heart	" 20	566
Improved Red	" 20	516
Improved Nantes	" 20	416
Half-long Scarlet Nantes	" 19	416
Early Scarlet Horn	" 18	400
French Horn	" 20	333

CUCUMBERS—Sown in hot-house April 3; set out May 26.

Variety.	In use.	Average length.
		Inch.
Giant Pera	July 27	12
Improved Long Green	" 25	11
Short Green	" 28	6
Long Green	" 26	12

TABLE CORN—Sown May 20.

Variety.	In Use, green.	Ripe.
Extra Early Adams	Aug. 29	None matured for seed.
Peep O'Day	" 24	" "
Earliest Catawba	Sept. 5	" "
Early White Cob	" 1	" "
Golden Bantam	" 5	" "
Early Fordhook	" 10	" "
White Squaw	Aug. 15	Sept. 20.
Red Squaw	" 17	" 20.
Kansas Soldier	Sept. 5	Did not mature for seed.

CELERY—Sown in hot-house April 3; Set out June 4.

Variety.	In use.	Weight of 1 dozen.
		Lbs.
White Plume	Aug. 21	15
Giant Pascal (C.E.F.)	Sept. 1	20
Giant White	" 1	19
Rose-ribbed	" 1	10
Dwarf White Solid	" 1	9
Paris Golden Yellow	" 1	10
Celeriac	" 1	9

CITRONS.

Sown in hot-house April 12; set out in garden May 26. Ready for use September 14. A good size, but not many set.

LETTUCE.

Variety.	In use.
Sown in Cold Frame, April 21.	
Big Boston	June 5.
Neapolitan	" 5.
Cos Trianon	" 7.
Tom Thumb	" 7.
1st Seeding in open, May 8.	
Cos Trianon	" 15
Tom Thumb	" 15.
Neapolitan	" 20.
Big Boston	" 15.
All the Year Round	" 15.
2nd Seeding in open, May 22.	
Cos Trianon	" 24.
Neapolitan	" 26.
Wheeler's Tom Thumb	" 26.
Nonpareil	" 24.
3rd Seeding in open, June 4.	
Cos Trianon	July 8.
Neapolitan	" 8.
Nonpareil	" 7.
Tom Thumb	" 10.
All the Year Round	" 12.

MUSK MELON.

Sown in hot-house April 12; set out May 28; None matured.

ONIONS—Sown in hot-house April 15; transplanted to garden May 20. Pulled September 23.

Variety.	Bushels per acre.
Paris Silverskin	416
Prizetaker	333
Yellow Globe	316
Red Wonder	316
Large Red Wethersfield	316
Danvers' Yellow Globe	216
Sown in open, May 6, pulled September 23.	
Prizetaker	300
Paris Silverskin	300
Red Wonder	283
Danvers' Yellow Globe	266
Large Red Wethersfield	266
Round Yellow Danvers	216
Red Wethersfield	200

An exceptionally fine crop of all varieties. Very even in size, with no small bulbs.

PARSNIPS—Sown May 10; Dug October 16.

Variety.	In use.	Bushels per acre.
Guernsey	July 30	450
The Student	" 30	450
Elcomb's Giant	Aug. 6	383

Parsley.

Curled Leaf, sown May 14; in use July 10; of good quality.

Garden Peas—Sown May 11.

Variety.	In use.	Ripe.
American Wonder	July 29	Aug. 25.
Shropshire Hero	" 27	" 25.
Laxton's Charmer	" 26	" 25.
Yorkshire Hero	" 29	Sept. 1.
Surprise	" 27	" 1.
Nott's Excelsior	" 26	" 1.
Burpee's Profusion	" 29	" 1.
Anticipation	" 28	" 1.
Leviathan	" 14	Aug. 20.
Perfection	" 28	Sept. 1.
Queen	Aug. 4	" 1.
Gradus	July 16	Aug. 20.
Dwarf Telephone	" 29	Sept. 1.
Stratagem	Aug. 1	" 1.
Rennie's Queen	July 28	" 1.
Admiral	" 26	Aug. 25.
Alaska	" 26	" 20.
Horsford's Market Garden	" 28	" 25.
Western Beauty	" 21	" 25.

Pumpkins—Sown in hot-house April 3; Set out May 26.

Variety.	Ready for use.	Ripe.	Average weight.
			Lbs.
Connecticut Field	Aug. 10	Sept. 15	15
Large Etampes	" 15	" 15	45
Large Cheese	" 10	" 15	20
Large Yellow Globe	" 10	" 15	75

Radishes.

Three seedings of radishes were made. Those sown on May 8 were ready to use June 15; sown May 22, in use June 24 and sown June 7, in use July 5. The varieties sown were—White-tipped, Early Scarlet, Olive Scarlet and Forcing Turnip, the last sort being hardly as good as the other three.

Rhubarb.

The old beds of rhubarb were in use from June 1 to September 18, giving an extra good crop.

Rhubarb seed was sown on May 28, to produce young plants for the following spring's distribution.

Spinach.

Two sorts, Victoria and Savoy-leaved, were sown on May 14; in use June 22 to July 5. A very good crop.

Tomatoes.

Sown in boxes in the house March 9 and 20; transplanted to pots in hot-house April 5; set out in garden May 25. The yield is the number of pounds of fruit both green and ripe taken on September 6 from three plants set three feet apart.

Variety.	Sown.	First ripe.	Yield of 3 plants.
New Earliana	March 20	July 29	51 lbs.
Spark's Earliana (C.E.F.)	" 20	" 29	36 "
Early Ruby	" 9	Aug. 10	30 "
Earliest of All	" 9	" 6	30 "
Early Jewel	" 20	" 16	24 "
Livingstone Globe	" 20	" 16	22 "

Tomato seeds were also sown in the hot-house on April 3, and set out in the garden on May 27. The yields are for the same number of plants at the same distance apart as the earlier sown plants, but were pulled September 18.

Variety.	First ripe.	Yield of 3 plants.
Spark's Earliana (C. E. F.)	Aug. 31	33 lbs.
Earliest of All	Sept. 1	27 "
Spark's Earliest (Burpee)	" 1	24 "
Early Ruby	" 2	24 "
Early Jewel	" 4	21 "

Squash—Sown in hot-house April 12; set out in garden May 26.

Variety.	Ready for Use.	Remarks.
Giant Crookneck	July 23	Large, good crop.
Custard Marrow	" 22	" "
Mammoth Whale	" 29	" "
Long White Bush	" 20	" "
Hubbard	" 31	" "
Custard Orange	" 28	" "
Custard	" 29	" "
White Congo	" 30	" "
Early Orange	" 27	" "
Long Vegetable Marrow	" 20	" "

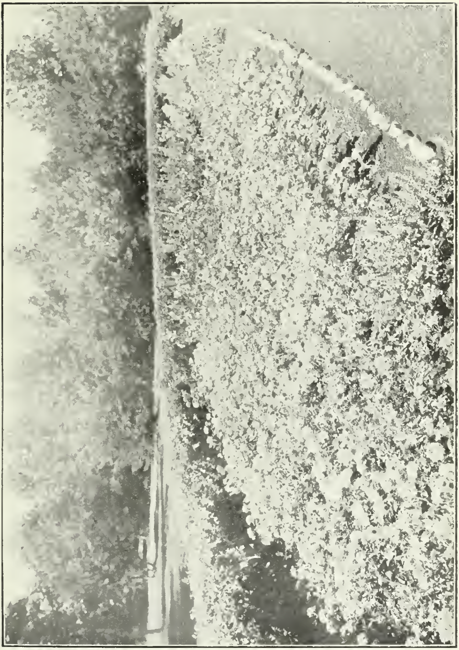
Sage.

Sown May 14; ready for use July 15; a good crop.

FRUITS.

The fruit crop was abundant over the province and nearly all sorts on the Experimental Farm gave large yields.

Many of the crab apple trees were loaded down; the wild plum trees also gave a fair crop.



Part of Flower Garden, Experimental Farm, Indian Head, Sask.

16—p. 408.

Part of Vegetable Garden, Experimental Farm, Indian Head, Sask.

Currants and gooseberry bushes were well loaded, but the currant fly did considerable injury, causing much of the fruit to dry up and fall.

Raspberry bushes gave a very large crop, and strawberries a fairly good one. A list of small fruits on the Farm is given.

RED CURRANTS.

Victoria,
Manitoba Amber,
London Red,
Early Scarlet,
Prince Albert,
Wilder,
Simcoe King,
Large Red,
North Star,
Red Grape,
La Conde,
Fay's Prolific,
Houghton Castle,
Raby Castle,
Rankin's Red,
Cherry,
Fertile D'Angers,
London Red,
New Red Dutch,
Victoria Red,
Long Bunch Holland,
La Conde,
Moore's Early,
Large Red,
Greenfield,
Benwell,
Cumberland Red,
Red English.

WHITE CURRANTS.

Fraueudorfer White,
Climax,
White Imperial,
White Dutch,
White Kaiser,
White Cherry,
White Pearl,
Verrier's White,
Large White,
White Grape,
Large White Brandenburg,
Wentworth Leviathan.

BLACK CURRANTS.

Eclipse,
Stirling,
Black English,
Gewohnliche,
Stewart,
Dominion,
Success,
Beauty,
Clipper,
Perry,
Ethel,
Star,
Crandall's Missouri,
Ogden,
Mattie,
Black Grape,
Merveille de la Gironde,
Standard,
Perth,
Oxford,
Ismay's Prolific,
Lewis,
Star,
Saunders,
Topsy,
Kerry,
Magnus,
Beauty,
Eagle,
Ethel,
Lee's Prolific,
Climax.

RED AND BLACK RASPBERRIES.

Columbia,
Cuthbert,
Marlboro,
Schaffer (purple),
Older (black),
Golden Queen (yellow),
Ruby Red,
Hilborn Black Cap,

RED AND BLACK RASPBERRIES—*Continued.*

Conrath (black),
Palmer (black),
King,
Cardinal,
Munger's (black),
Sunbeam,
Herbert,
Dr. Reider,
Turner.

GOOSEBERRIES.

Industry,
Downing,
Houghton's Seedling,
Companion,
Troy,
Cluster,
Ruth,
Governess,
Smith's Improved,
Edna,
Mabel,
Gibb,
Saunders,
York,
Griffin,
Sussex,
Rideau,
Sandow,
Merton,
Red Jacket.

STRAWBERRIES.

Senator Dunlap,
S. Dakota No. 1,
S. Dakota No. 2.

BLACKBERRIES.

Eldorado,
Mersereau,
Ancient Briton.

CROSS-BRED APPLES.

When picking the crop of cross-bred apples, a record was kept of the weight of fruit gathered from some of the best trees, and is given below. The date of picking was September 15.

Orchard.	Row.	No.	Name.	Year Planted.	Year began Fruiting.	Weight of Fruit in 1909.	Average Diameter
						Lbs.	Inches.
IV...	3	5	Cavan	1901	1904	155	1½
IV...	3	6	"	1901	1904	80	1⅓
IV...	3	13	Pyrus Baccata x Tetofsky No. 45	1901	1904	56	1⅜
IV..	4	11	Aurora	1903	1907	106	1¼
IV...	4	12	"	1903	1907	148	1¼
IV...	4	13	"	1903	1907	58	1¼
IV...	4	14	"	1903	1907	38	1¼
IV...	4	17	No. 116	1901	1907	52	1¼
IV...	5	1	Charles	1903	1909	71	1½
IV...	5	2	"	1903	1907	48	1¼
IV ..	5	3	"	1903	1908	40	1¼
IV...	5	4	"	1903	1907	60	1½
IV...	5	9	Derby	1903	1907	100	1⅜
IV...	5	13	Pioneer	1903	1907	48	1⅛
VII...	8	18	Prince	1905	1909	16	1½

SEEDLING PLUMS.

All the varieties, 17 in number, of seedling plums obtained from the Experimental Station at Brookings, S. Dakota, in 1908, came through the winter safely. Two of the varieties fruited to a small extent, but did not fully ripen.

FRUIT TREES AND BUSHES PLANTED, 1909.

CROSS-BRED APPLES.

From E. D. Smith, Winona, Ont.

25 Prince,	20 Sylvia,	10 Carleton,
35 Magnus,	40 Jewel,	10 Eve.
20 Tony,	10 Elsa,	10 Osman,
5 Bow,	20 Dawn,	10 Charles,
25 Pioneer,	30 Golden,	30 Alberta.

RASPBERRY AND BLACKBERRY BUSHES.

From the Central Experimental Farm, Ottawa.

20 Early King Raspberry,	12 Eldorado Blackberry,
20 Schaffer's Colossal,	20 Kansas Black Cap.
20 Snyder Blackberry,	

FLOWERS.

The season for flowers was exceptionally favourable and the bloom has not often been as profuse as it was last year.

ANNUALS.

Variety.	Sown in Hothouse.	Trans-planted.	In Bloom From	In Bloom To
Antirrhinum	April 5	May 31	July 14	October 8
Asters, 13 varieties	" 3	" 27	" 14	" 8
Balsams	" 3	" 25	" 11	" 8
Candytuft	" 5	" 28	" 19	" 8
Dianthus, 5 varieties	" 5	" 31	" 7	" 8
Gaillardia picta	" 6	" 31	" 7	" 8
Mignonette	" 5	June 5	" 24	" 8
Nasturtium	" 3	May 11	June 21	" 8
Nicotiana affinis	" 5	June 5	" 24	" 8
Pansy, 10 varieties	" 5	" 31	July 2	" 9
Petunias	" 3	" 31	" 1	" 9
Phlox, 3 varieties	" 3	" 31	" 2	" 9
Portulaca	" 3	" 31	" 2	" 9
Salpiglossis	" 5	" 15	" 29	" 9
Stocks (10 weeks)	" 3	" 15	Aug. 3	" 9
Verbena	" 3	" 31	July 14	" 9
Zinnia	" 12	" 29	" 1	" 9

ANNUALS—Sown in Open Garden on May 15.

Variety.	Sown.	In Bloom From	In Bloom To
Abronia umbellata	May 15	Aug. 17	October 8
Antirrhinum	" 15	July 19	" 8
Brachycome	" 15	" 26	" 8
Bartonia	" 15	" 15	" 8
Calendula	" 15	" 15	" 8
Clarkia	" 15	" 25	" 8
Coreopsis	" 15	" 24	" 8
Candytuft	" 15	June 19	" 8
Godetia	" 15	Aug. 3	" 8
Helichrysum	" 15	July 31	" 8
Iceland Poppy	" 15	June 7	" 8
Mignonette	" 15	July 15	" 8
Nasturtium	" 15	" 20	" 8
Pansies	" 15	" 15	" 8
Scabiosa	" 15	Aug. 17	" 8
Salpiglossis	" 15	July 27	" 8
Single Red Poppy	" 15	June 7	" 8
White Feathered Poppy	" 15	" 27	" 8
Sweet Peas (27 varieties)	April 5	" 19	" 8

PERENNIALS.

Variety.	In Bloom From	In Bloom To
Achillea Millefolium	July 3	Oct. 8
Achillea Ptarmica	" 3	" 8
Blue Squills	May 18	June 1
Bleeding Heart	June 10	July 28
Columbine	" 15	" 24
Comfrey	July 2	Aug. 23
Carnations	" 10	Oct. 6
Clematis, Blue	" 11	" 7
Clematis recta	" 1	Aug. 9
Campanula	" 19	Sept. 20
Centaurea, Yellow	" 21	Aug. 25
Clematis	" 7	Oct. 8
Centaurea	June 19	July 15
Everlasting	" 10	June 29
German Iris	" 9	" 29
Golden Glow	Aug. 5	Oct. 8
Gladioli	" 7	" 7
Helianthus (Sunflower)	July 26	" 8
Hemerocallis	" 27	Sept. 4
Iris Siberica	June 12	July 8
Japanese Paeonies	July 11	Aug. 14
Larkspur	" 9	Sept. 1
Lilies (Several Kinds)	" 13	Oct. 28
Lupinus Polyphyllus	" 14	Aug. 23
Lily of the Valley	June 10	June 16
Oriental Poppy	July 5	July 24
Paeony (Tenuifolia)	" 10	June 29
Paeonies (Assorted Varieties)	" 29	July 30
Phlox (Perennial)	Aug. 6	Oct. 8
Pyrethrum	Sept. 23	" 12
Perennial Asters	" 23	" 12
Sweet William	June 29	" 8
Sidalcea candida	July 5	Aug. 25
Spirea Filipendula	" 7	" 7
Shasta Daisy	" 7	Sept. 1
Sunflowers (tall annual)	Aug. 10	" 10
Tulips	May 25	June 26
Tall Lychnis (Maltese Cross)	July 5	Sept. 12
Tall White Iris	" 26	Aug. 5
Veronica Spicata	" 11	" 14

FLOWERING SHRUBS.

Last year was an exceptionally fine season for all flowering shrubs, and those on the Farm surpassed all former years. This was notably the case with the lilacs, which were very beautiful indeed, no less than 24 varieties being in bloom during the season. The following is a list of shrubs and dates while in bloom:—

Variety.	In Bloom.		Variety.	In Bloom.	
	From.	To.		From	To
Lilacs.			*Lilacs.*—Con.		
Mons. Maxime Cornu	June 5.	July 20.	Michael Buchner	June 5.	July 20
Rubella Plena	" 5.	" 23.	Villosa	" 18.	" 30
Condorcet	" 7.	" 23.	Vulgaris grandiflora	" 5.	" 23
La Tour d'Auvergne	" 7.	" 23.			
Mathieu de Dombasle	" 8.	" 23.	*Other varieties of Shrubs.*		
De Marley	" 5.	" 21.			
President Grevy	" 5.	" 23.	Golden Currant	June 5.	June 17
Lemoine	" 7.	" 24.	Viburnum Lantana	" 8	" 21
Persian Lilac	" 11.	" 9.	American Elder	" 8.	" 21
Madame Casimir Perier	" 5.	" 23.	Saskatoon Berry	" 5.	" 11
Chas Joly	" 7.	" 23.	Hawthorn	" 8.	" 21
Francisque	" 5.	" 20.	Caragana (6 Varieties)	" 10.	" 25
Congo	" 6.	" 22.	Cytisus Capitatus	" 10.	" 30
Mme. Legraye	" 5.	" 23.	Japanese Quince	" 10.	July 12
Abel Carriere	" 7.	" 20.	Dogwood (Cornus)	" 10.	" 9
Madam Lemoine	" 8.	" 24.	High bush Cranberry	" 17	" 2
Alphonse Lavallée	" 8.	" 23.	Berberis	" 19.	" 2
Emodi	" 5.	" 20.	Roses (single varieties)	" 19.	Oct. 9
Virginité	" 6.	" 22.	Spirea (4 Varieties)	" 19.	July 6
Josikea	" 8.	" 29.	Virburnum	" 20.	June 30
Chas X	" 5.	" 23.	Mountain Ash	" 14.	" 26

TREES AND SHRUBS PLANTED.

The following trees and shrubs were sent up in May last from the Central Experimental Farm, Ottawa, and planted out:—

2 *Neillia Torreyi.*
2 *Cimicifuga racemosa.*
100 *Spiræa Van Houttei.*
100 *Lonicera grandiflora rosea.*
2 *Rhus glabra.*
2 *Rhus glabra laciniata.*
2 *Rhus aromatica.*
2 *Rhus typhina.*
1 *Rhus typhina laciniata.*
2 *Rhurs Cotinus.*
2 *Rhus Cotinus atropurpurea.*
100 *Rosa rugosa.*
2 *Caragana ambigua.*
2 *Caragana Chamlagu.*
2 *Salix elegantissima.*
2 *Salix glabra phylicifolia.*
1 *Populus heterophyllus.*
2 *Populus Wobstii.*
1 *Populus Charkovensis.*
2 *Robinia viscosa.*
2 *Hypericum van Fleeti.*
2 *Phelodendron amurense.*
2 *Amelanchier Utahense.*
1 *Spiræa Menziesii triumphans.*
2 *Spiræa betulifolia superba.*

EXCURSIONS TO THE EXPERIMENTAL FARM.

The Department of Agriculture, Regina, ran excursions last year on July 23 and 24 to the Experimental Farm from all points along the Soo and Estevan line, the

Regina and Arcola line and on the main line west to Moosejaw from the eastern boundary of the province. Over three thousand came by train on the two days and very large numbers drove in from the surrounding districts.

The Hon. W. R. Motherwell, Minister of Agriculture, President Murray and Prof. Rutherford, of the University and Agricultural College, Saskatoon, gave acceptable addresses on both days.

The Lady Directors of the Hospital provided a lunch for the visitors. A sufficient number of comfortable conveyances were provided, and all visitors were able to drive about the Farm. Everything passed off satisfactorily, and no injury was done by the great throng that visited every part of the Farm.

PREPARING LAND FOR GRAIN CROPS IN SASKATCHEWAN.

During the growing season of 1908, almost the entire westeru portion of the province suffered from dry weather, and the majority of the new settlers, either from unfamiliarity with the methods of cultivation for the couservation of moisture, or through a desire to bring the greatest possible area under cultivation, naturally suffered a severe disappoiutment.

In some districts, where in former years moisture had been abundant and proper cultivation had in consequence been neglected in the effort 'to get rich quick,' the partial failure of the crop proved an expensive lesson.

For many years, commencing in 1888, the methods of conserving moisture by 'breaking and backsetting' and by 'summer-fallowing'—now called 'dry-farming' for a change—have been recommended and universally adopted by the older settlers but to very many of the new settlers they are unknown. The latter, I trust, may be benefited by the following explanation of the methods which, for a great many years, have proved uniformly successful for every district in the province of Saskatchewan.

BREAKING PRAIRIE SOD.

The success or failure of a new settler often depends on the method employed in the preparation of the land for his first crop, and it is, therefore, of the utmost importance that the question of 'breaking' or 'breaking and backsetting' be given the consideration it deserves.

For some years past, the general practice throughout the country has been to continue breaking three or more inches deep so long as the teams can turn over the sod; then, in the fall, to disc the topsoil, and sow grain on the spring following. From the breaking so done before the end of June, a good crop of wheat, oats or barley is usually obtained, but no amount of cultivation will ensure even a fair crop on this land in the next succeeding year. After the first crop has been cut the soil is usually in a perfectly dry state, and remains so, in spite of any known method of cultivation, until the rains come in the following spring. If they are insufficient or late, as is frequently the case, failure of the crop must be the result.

BREAKING AND BACKSETTING.

Breaking and backsetting is the true way of laying the fouudation of future success in the greater number of districts throughout the province, and while this method does not permit of as large an acreage being brought under cultivation in a year, it does permit of more thorough work and ensures better results in the long run. The anxiety of nearly all settlers to sow every acre possible, regardless of how or when the work on the land has been accomplished, may be given as the reason for breaking and discing to a large extent superseding the older, better and safer plan.

Breaking and backsetting means the ploughing of the prairie sod as shallow as possible before the June or early July rains are over, and, in August or September, when the sod will have become thoroughly rotted by the rains and hot sun, ploughing two or three inches deeper in the same direction, and then harrowing to make a fine and firm seed-bed. From land prepared in this way, two good crops of wheat may be expected. The first crop will be heavy, and the stubble, if cut high at harvest time, will retain sufficient snow to produce the moisture required, even in the driest spring, to germinate the seed for the next crop. The stubble land can readily be burned on a day in the spring with a hot, steady wind, and the seed may be sown with or without further cultivation. In a case where the grass roots have not been entirely killed by the backsetting, a shallow cultivation before seeding will be found advantageous, but as a rule the harrowing of the land with a drag-harrow after seeding will be sufficient.

The principal objection to breaking and backsetting is urged with regard to the backsetting, which is, no doubt, heavy work for the teams, but, if the discing required to reduce deep breaking, and afterwards the ploughing or other cultivation that must be done in an effort to obtain a second crop be taken into consideration, it must be conceded that in the end 'breaking and backsetting' is the better method.

When two crops have been taken from new land it should be summer-fallowed.

SUMMER-FALLOWS AND SUMMER-FALLOWING.

Among the many advantages to the credit of the practice of summer-fallowing may be mentioned: the conservation of moisture, the eradication of weeds, the preparation of land for grain crops when no other work is pressing, the availability of summer-fallowed land for seeding at the earliest possible date in the spring, and the minor advantages of having suitable land for the growing of pure seed, potatoes, roots and vegetables at the least cost and with the greatest chance for success, and that of being able to secure two crops of grain with little or no further cultivation.

Summer-fallowing has undoubtedly some disadvantages, but so long as the growing of grain, and more particularly wheat, remains the principal industry of the province, it will be necessary to store up moisture against a possible dry season, to restrain the weeds from over-running the land, and, on account of the short seasons, to prepare at least a portion of the land to be cropped, in the year previous to seeding. A well-made summer-fallow is the best means to this end. Among the disadvantages are: the liability of the soil to drift, the over-production of straw in a wet season (causing late maturity and consequent danger of damage by frost), and, it is claimed, the exhaustion of the soil. The two former may, to a great extent, be overcome by different methods of cultivation, and, if the soil can be prevented from drifting, I am satisfied that one of the reasons for the latter contention will disappear.

Various methods are practised in the preparation of fallow, and where the aim has been to take advantage of the June and July rains and to prevent the growth of weeds, success is almost assured. Where the object has been to spend as little time as possible on the work, failure is equally certain.

In my annual report of 1889, the following was submitted for the consideration of the settlers. Since then many experiments have been conducted on the Experimental Farm with different systems, and again I submit what, on the whole, have been found to be the most successful methods for the cultivation of the soil in Saskatchewan.

FROM REPORT OF 1889 (DECEMBER 29).

'The year just past has been one of extremes; last winter was one of the mildest on record, and March was so very fine that thousands of acres of grain were seeded from the 15th to the 31st, and at no time in the history of the country has the ground been in better condition for the reception of the seed. Immediately after seeding, however, exceptionally high winds set in, followed by extreme drought during the entire

growing season. In many places the crops were injured by the winds, and finally almost ruined by the succeeding dry weather. In some localities, however, where the farming had been done in accordance with the requirements of the country, the crops did fairly, and considering the excessively dry weather, remarkably well.

'The Experimental Farm suffered in company with every other farm in the country. Perhaps very few suffered as much from winds, but the dry weather, though reducing the yields, did not prove as disastrous as to many others. In this portion of the Territories at least, every settler knows the importance of properly preparing his land. For several years after the country became open for settlement, every one imagined that grain would grow, no matter how put in, but now the man is devoid of reason who thinks he is sure of a crop without any exertion on his part. It is true that since 1882 we have had one year in which the land required little or no preparation for the production of an abundant crop, but only too many realize the loss in the remaining years from poor cultivation.

'Our seasons point to only one method of cultivation by which we may in all years expect to reap something. It is quite within the bounds of possibility that some other and perhaps more successful method may be found, but, at present, I submit that 'fallowing' the land is the best preparation to ensure a crop. Fallowing land in this country is not required for the purpose of renovating it, as is the case with the worn-out lands in the east; and it is a question as yet unsettled how much or how little the fallows should be worked, but, as we have only one wet season during the year, it has been proved beyond doubt that the land must be ploughed the first time before this wet season is over if we expect to reap a crop in the following year. The wet season comes in June and July, at a time when every farmer has little or nothing else to do, and it is then that this work should be done. Usually seeding is over by the first of May, and, to secure the best results, the land for fallow should be ploughed from 5 to 7 inches deep as soon after this date as possible. Land ploughed after July is of no use whatever unless the rains in August are much in excess of the average. A good harrowing should succeed the ploughing, and all weeds and volunteer grain be kept down by successive cultivations. A good deal of uncertainty is felt with regard to a second ploughing; some holding that it is useless; others maintaining that it is an injury; while others again have found it to give from five to ten bushels per acre more than one ploughing. So far, the experiments on the Experimental Farm have shown that by far the best returns have been received from two ploughings, and more noticeably was this the case when the first ploughing has been completed in May or June. Without doubt, two ploughings cause a greater growth of straw, and consequently, in a wet year, the grain is several days later in maturing, causing greater damage from frost; but taking the seasons so far passed (1884 excepted), two ploughings with as much surface cultivation as possible in between, may be safely recommended.

'Above all, it is of the greatest importance that the first ploughing be as deep as possible, and that it be done in time to receive the June and July rains.'

FROM REPORT OF 1906.

'In view of the fact that every year brings to the Northwest many new settlers who are unacquainted with the methods of breaking up and preparing new land for crop, a few suggestions with regard to this very important work may not be amiss.

'In all sections where the sod is thick and tough, breaking and back-setting should be done; while in districts where scrub abounds and the sod is thin, deep breaking is all that is necessary.

'The former is generally applicable to the southern parts of Saskatchewan and the latter to Alberta and the northern parts of Saskatchewan, where the land is more or less covered with bluffs.

SHALLOW-BREAKING AND BACK-SETTING.

'The sod should be turned over as thin as possible, and for this purpose a walking plough with a 12 or 14-inch share, is the best. When the breaking is completed (which should not be later than the second week in July), rolling will hasten the rotting process and permit back-setting to commence early in August.

'Back-setting is merely turning the sod back to its original place, and at the same time bringing up two or three inches of fresh soil to cover it. The ploughing should be done in the same direction as the breaking and the same width of furrow turned. Two inches below the breaking is considered deep enough, but three to four inches will give better results.

'After back-setting, the soil cannot be made too fine, and the use of the disc or Randall harrow to cut up every piece of unrotted sod, will complete the work.

DEEP BREAKING.

'Deep breaking, which in many sections of the country is the only practicable way of preparing new land, and which is, unfortunately, done in some instances where breaking and back-setting would give more satisfactory results, consists in the turning over of the sod as deeply as possible, usually from four to five inches.

'When the sod has rotted, the top soil should be worked and made as fine as possible. The use of harrow and disc will fill up all irregularities on the surface, and make a fine, even seed-bed.

'Whether the land is broken shallow or deep, it is necessary to have the work completed early, so as to take advantage of the rains which usually come during June or early in July. These rains cause the sod to rot, and without them, or if the ploughing is done after they are over, the sod remains in the same condition as when turned, and no amount of work will make up for the loss.

SUMMER-FALLOWS.

'The true worth of properly prepared fallows has been clearly demonstrated in past years in every grain-growing district of Saskatchewan.

'The work of preparing land for crop by fallowing is carried on in so many ways in different parts of the Northwest, that perhaps a few words on some of the methods employed may be of help to at least some of the new settlers.

'It has been observed in Alberta and Saskatchewan that the land to be fallowed is not, as a rule, touched until the weeds are full grown and in many cases, bearing fully matured seed. It is then ploughed.

'By this method, which, no doubt, saves work at the time, the very object of a summer fallow is defeated. In the first place, moisture is not conserved because the land has been pumped dry by the heavy growth of weeds; and, secondly, instead of using the summer-fallow as a means of eradicating weeds, a foundation is laid for years of labour and expense by the myriads of foul seeds turned under.

'The endless fields of yellow-flowered weeds, generally Ball Mustard (*Neslia paniculata*), testify to the indifferent work done in many districts, and, while no weed is more easily eradicated by a good system of fallows, there is no weed that is more easily propagated or takes greater advantage of poor work on fallows or of fall or spring cultivation.

'As has been pointed out in my previous reports, early and thorough work on fallows is absolutely necessary to success, and I here repeat the methods and results of tests carried on for some years past.

'*First Method.*—Ploughed deep (6 to 8 inches) before the last of June; surface cultivated during the growing season, and just before or immediately after harvest ploughed 5 or 6 inches deep.

'Result.—Too much late growth if season was at all wet; grain late in ripening. and a large crop of weeds if the grain was in any way injured by winds.

'*Second Method.*—Ploughed shallow (3 inches deep) before the last of June; surface cultivated during the growing season, and ploughed shallow (3 to 4 inches deep) in the autumn.

'Result.—Poor crop in a dry year; medium crop in a wet year. Soil not sufficiently stirred to enable it to retain the moisture.

'*Third Method.*—Ploughed shallow (3 inches) before the last of June; surface cultivated during the growing season, and ploughed deep (7 to 8 inches) in the autumn.

'Result.—Soil too loose and does not retain moisture. Crop light and weedy in a dry year.

'*Fourth Method.*—Ploughed deep (7 or 8 inches) before the last of June; surface cultivated during the growing season.

'Result.—Sufficient moisture conserved for a dry year, and not too much for a wet one. Few or no weeds, as all the seeds near the surface have germinated and been killed. Surface soil apt to blow more readily than when either of the other methods is followed. For the past fourteen years, the best, safest and cleanest grain has been grown on fallow worked in this way, and the method is therefore recommended.

'Fallows that have been ploughed for the first time after the first of July, and especially after July 15, have never given good results; and the plan too frequently followed of waiting till weeds are full grown, and often ripe, and ploughing under with the idea of enriching the soil, is a method that cannot be too earnestly advised against.

'In the first place, after the rains are over in June or early in July, as they usually are, no amount of work, whether deep or shallow ploughing, or surface cultivation, can put moisture into the soil. The rain must fall on the first ploughing and be conserved by surface cultivation.

'Weeds, when allowed to attain their full growth, take from the soil all the moisture put there by the June rains, and ploughing under weeds with their seeds ripe or nearly so, is adding a thousand-fold to the myriads already in the soil, and does not materially enrich the land.'

DRY FARMING.

During the past two years the term 'dry farming' has been applied in Alberta to what was formerly known in the west as 'summer fallowing.'

With the exception of the addition of the use of a soil-packer, there is no change in the methods formerly employed, when the spring rains and frequent cultivation were depended upon for the packing of the soil.

A packer is, without doubt, a most useful implement on the farm, and where from any cause the soil is loose, it should be used. It is, however, an expensive implement, and within the means of comparatively few of the new settlers. Fortunately, early ploughing and frequent shallow cultivation may be depended upon to produce equally satisfactory results.

CULTIVATION OF STUBBLE.

When farmers summer-fallow one-third of their cultivated land each year, as they should, one-half of each year's crop will be on stubble. For wheat, the best preparation of this land is to burn the stubble on the first hot, windy day in the spring, and either cultivate shallow before seeding or give one or two strokes of the harrow after seeding; the object being to form a mulch to conserve whatever moisture may be in the soil until the commencement of the June rains.

The portion intended for oats or barley should be ploughed four or five inches deep, and harrowed immediately; then seeded and harrowed as fine as possible. In

case time will not permit ploughing, good returns may be expected from sowing the seed oats or barley on the burnt ground and discing it in; then harrowing well.

FALL PLOUGHING.

With regard to fall ploughing, it may be said that, as a rule, on account of short seasons and dry soil, very little work can possibly be done in the fall, but if the stubble land is in a condition to plough and the stubble is not too long, that portion intended for oats and barley may be ploughed, if time permits.

It is, however, a mistake to turn over soil in a lumpy or dry condition, as nine times out of ten it will remain in the same state until May or June, with insufficient moisture to properly germinate the seed, and the crop will be overtaken by frost.

CATTLE.

The herd on the Farm consists of 34 pure Shorthorns and 19 grade cattle as follows: 2 bulls, 14 and 19 months old respectively, 4 bull calves, 23 cows and heifers and 5 heifer calves, 3 grade cows and 19 grade steers. All were tested for tuberculosis in the fall and found quite healthy.

FEEDING TEST.

A test was carried on during the past winter of feeding 8 steers between 3 and 4 years of age, and 8 steers between 2 and 3 years of age, the exact ages not being known, with the object of comparing the gains made by the younger and older lots. The test commenced, after a preparatory feeding of two weeks, on November 30 and finished on March 22, a period of 16 weeks.

The ration was the same for both lots, consisting of all the cut oat straw and corn ensilage the animals would eat, equal parts of ground barley and oats, and linseed meal.

Lot No. 1 (3 to 4 year steers) consumed 70 lbs. of straw and 170 lbs. of ensilage daily.

Lot No. 2 (two to three year steers) consumed 65 lbs. of straw and 155 lbs. of ensilage daily.

Both lots were fed 6,048 lbs. of meal and 896 lbs. of linseed during the 16 weeks. This was 3, 6, 8, and 10 lbs. per day for four months respectively, and 1 lb. linseed meal daily.

No value is placed on the straw. The steers, excepting one, were purchased, and were obtained part in Saskatchewan and part in Manitoba, 10 being Shorthorn grades and 6 Polled Angus grades.

Weights and Gains.

—	Lot No. 1. — 3 and 4 years old.		Lot No. 2. — 2 and 3 years old.	
	Weight.	Gain.	Weight.	Gain.
	Lbs.	Lbs.	Lbs.	Lbs.
Start of Test	9,290	....	7,675	
End of 1st Month	9,730	440	8,205	530
" 2nd Month	10,120	390	8,550	345
" 3rd Month	10,585	465	8,870	320
" 4th Month	11,140	555	9,230	360
Total gain during test	....	1,850	....	1,555
Average gain per head	....	231¼	....	194⅜

TOTAL WEIGHT and estimated Value of Feed consumed.

—	Lot No. 1.		—	Lot No. 2.	
	Weight.	Value.		Weight.	Value.
	Lbs.	$ cts.		Lbs.	$ cts.
Straw	7,840	....	Straw	7,280	....
Ensilage	18,840 at 20c. per ton	18 84	Ensilage	17,360 at $2.00 per ton	17 36
Meal	6,048 at 1c. per lb	60 48	Meal	6,048 at 1c. per lb	60 48
Linseed	896 at 3c. per lb	26 88	Linseed	6,048 at 3c. per lb	26 88
Total cost		106 20	Total cost		104 72
Cost per head		13 27½	Cost per head		13 09

SUMMARY of the Financial Results of the Transaction.

—	Lot No. 1.	Lot. No. 2.
Weight at Start	9,290 lbs.	7,280 lbs.
Value at 3¼ cents	$301 92	$249 43
Cost of feed	$106 20	$104 72
Weigth at finish	11,140 lbs.	9,230 lbs.
Value at 5¼ cents	$584 85	*$461 50
Net Gain	$177 05	$107 43
Net profit per head	$22 13	$13 42

* At 5 cents.

BEES.

I am sorry to report poor success with bees during the past year. Although the season was a fine one for honey, none of the swarms made any surplus.

On November 8 last, 5 hives were put into the cellar, and on March 2 were taken out, on account of the warm weather.

Three of the swarms were dead, with considerable honey in each hive. The remaining swarms are very weak, with abundance of honey.

HORSES.

Twelve horses are at present on the Farm. Ten of these are draft horses and 2 light animals are used for driving. Three of the draft animals are aged and only fit for light work.

SWINE.

Two breeds are kept at present, Yorkshire Whites and Berkshires and consist of males and females of each breed.

During the past year, 7 pigs were sold for breeding purposes, and 29 for pork.

POULTRY.

Barred Plymouth Rocks and Black Minorca fowls are kept on the Farm.

DISTRIBUTION OF SAMPLES.

A distribution of samples of the products of the Farm was made in the spring to residents of Saskatchewan. The distribution to residents in Alberta from this farm was discontinued, as these are now supplied from the Experimental Farms at Lethbridge and Lacombe in that province.

Following is a list of the samples sent out:—

Wheat, 3-lb. bags	206
Oats, 3-lb. bags	155
Barley, 3-lb. bags	52
Peas, 3-lb. bags	60
Sundries (flax, rye), 3-lb. bags	14
Potatoes, 3-lb. bags	500
Total	987

CORRESPONDENCE.

During the twelve months ending March 31, 1910, 6,963 letters were received and 6,908 mailed from this office.

In letters received, reports on samples are not included, and, in letters mailed, circulars of instructions sent out with samples are not counted.

METEOROLOGICAL RECORDS.

Month.	Temperatures.					Rainfall.		Snowfall.	Bright Sunshine.
	Maximum.		Minimum.		Mean.				
1909.	Date.	°	Date.	°	°	Days.	In.	In.	Hours.
April	25	56	13	1	28·23	2	13	0·13	176.1
May	27	81	1	11	49·29	7	2·92	0·25	216 4
June	18	86	24	34	59·27	11	2·30	....	224 4
July	24	90	14	48	64·22	11	4 89	....	236 3
August	26	91	28	38	63·13	7	3·58	....	320 5
September	8	86	22	29	57· 8	1	·14	....	233.6
October	5	79	12	2	38·66	1	·14	·5	137 4
November	2	57	20	—20	17·92	2	·16	9·25	76 8
December	30	33	5	—30	1·42	.....	......	12·00	35 7
1910.									
January	25	36	3	—40	6· 7	1	·10	·5	78 8
February	28	36	23	—30	0·77	......	......	6 00	113 4
March	22	76	1	—5	36·13	3	1·29	·25	154 8
						46	15 65	28 88*	2,004 2

* Reckoning ten inches of snowfall as equivalent to one inch of rainfall the total precipitation for the year ending March 31, 1910, was 18·538 inches.

I have the honour to be, sir,

Your obedient servant,

ANGUS MACKAY,

Superintendent.

EXPERIMENTAL FARM FOR CENTRAL SASKATCHEWAN

REPORT OF WM. A. MUNRO, B.A., B.S.A., SUPERINTENDENT.

ROSTHERN, SASK., March 31, 1910.

Dr. WM. SAUNDERS, C.M.G.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to present the first annual report of the work done on the Dominion Experimental Farm for Central Saskatchewan, established at Rosthern.

SITUATION AND CONDITION OF FARM.

The Farm is situated half a mile south of the town of Rosthern, adjoining and east of the Canadian Northern Railway and is in full view from the passing trains. It consists of about 152 acres, most of which had been cropped for a number of years previous to its purchase by the Dominion Government. There were on it a poorly constructed house and a small stable and implement shed.

PURCHASE OF FARM HORSES AND IMPLEMENTS.

The Farm was purchased in 1908 and the appointment of the Superintendent was made in March, 1909. Previous to my arrival, Mr. Angus Mackay, Superintendent of the Experimental Farm at Indian Head, Sask., had been directed to make purchases of horses and implements for this Farm, which he did in a very creditable manner. The horses, especially, were a very fine lot, consisting of four heavy draft, one general-purpose and a heavy carriage horse.

In the early part of March, 1910, three of the horses became infected with influenza. One of them recovered after a mild illness, another was quite seriously affected but slowly recovered, and the third died.

FENCING.

The Farm had been fenced with three strands of barbed wire on spruce posts, most of which were badly decayed. This fence was removed and a ten-strand woven wire fence put in its place. The posts are cedar, five-inch top and one rod apart.

TREATMENT OF LAND THE FIRST YEAR.

The land had been cropped in 1908 with wheat and oats and had been left unploughed. As it had been reported to be weedy, it was thought wise to summer-fallow it the first year, rather than to attempt any experimental work. About twenty acres were sown to oats, two acres to potatoes and the balance ploughed and thoroughly worked all summer. A hail storm on August 8 ruined the oat crop and greatly injured the potatoes and shrubs.

TREES AND SHRUBS.

More than a thousand trees and shrubs were received from the Central Experimental Farm, Ottawa. Two rows of trees, twenty feet apart in the row and twenty feet between the rows, and one row of shrubs ten feet apart in the row and twenty feet from the inside row of trees were planted on the east, north and most of the west side of the Farm. The trees consisted of American White Elm, Green Ash, Manitoba Maple, Russian Poplar and Hackberry. The shrubs were made up of a great number of varieties, most of which have been tested and have proven hardy in this climate. Those trees and shrubs which were not planted in these rows were heeled in a nursery and stood the season fairly well.

NEW BUILDINGS.

During my illness, caused by a severe fall on June 3, the foreman, Mr. Paul C. Black, under your direction, built a machinery shed and had some improvements made on the foreman's house which is now a rather fine-looking building, but the old part of which was reported as being very cold during the winter months. The implement shed is 20 feet x 60, with a shanty roof. It is well constructed, but is hardly large enough to house all the implements.

The Superintendent's house, contracted for in July, was not sufficiently completed to be occupied until the middle of February. As the nearest house obtainable during this period was a mile and a half from the Farm, a great deal of inconvenience in the supervision of the work was caused on account of the distance to be travelled.

CORRESPONDENCE.

The correspondence has not been very heavy during the past year, the total number of letters received being 350 and those sent out 308.

MEETINGS ATTENDED.

The many duties incident to getting the Farm in readiness for the coming year somewhat handicapped me in becoming acquainted with other sections of the province by attending meetings. However, I was enabled to act as judge at five seed fairs, to speak at three Institute meetings, to attend the Agricultural Societies' Convention at Regina, and the Saskatchewan Grain Growers' Convention at Prince Albert, from all of which much was learned of the conditions prevailing in the province which will serve as a guide in the conducting of Experimental Farm work in the future.

I have the honour to be, sir,

Your obedient servant,

WM. A. MUNRO,

Superintendent.

EXPERIMENTAL FARM FOR SOUTHERN ALBERTA

REPORT OF W. H. FAIRFIELD, M.S., SUPERINTENDENT.

LETHBRIDGE, ALTA., March 31, 1910.

Dr. WILLIAM SAUNDERS, C.M.G.,
Director, Dominion Experimental Farms,
Ottawa, Ont.

SIR,—I have the honour to submit the third annual report of the operations on the Experimental Farm for Southern Alberta, at Lethbridge, for the year ending March 31, 1910. Two seasons' crops have been grown, the first spring and summer after the Farm was established being devoted to the breaking and preparation of the sod.

The season of 1909 was somewhat remarkable, owing to the fact that the total precipitation for the calendar year was less than has been experienced for a number of years and also because of the exceptionally light rainfall for the month of June. Official meteorological observations have been taken at the city of Lethbridge since 1902. The average precipitation for the eight years has been 16·77 inches. The total precipitation recorded at this Farm from January 1 to December 31, 1909, was 10·32 inches. In this the snowfall is reduced to water by calculating ten inches of snow to be equivalent to one inch of water. At the end of this report is a table which gives the precipitation each month from April 1, 1909, to date. The total precipitation for the first three months of 1909 was 1·0 inches. A point that should not be lost sight of is that the amount of precipitation in one year affects the crop returns the following season in a very appreciable manner. Some of the moisture from the very heavy rains of June, 1908, was doubtless carried over in our retentive sub-soil to aid crops in 1909, even on land that had produced a crop of grain in 1908. On land summer-fallowed in 1908, the major portion of this moisture was carried over, well down in the sub-soil, for the use of the 1909 crop. Carrying this idea out, it is reasonable to suppose that there was not as much moisture left in the sub-soil after the crop of 1909 was taken off, owing to the lighter rainfall of 1909, as there was in the fall of 1908. This point is of interest owing to its bearing on the coming crop of the season of 1910.

During the winter of 1908-9, some low temperatures were recorded at the end of December and the first half of January. The rest of the winter was not particularly severe.

The first work done on the land in the spring of 1909 was some harrowing on March 17. Although it was not possible to work continuously on the land from this date to the first of April, considerable harrowing and discing was accomplished. By April 1, ploughing and seeding was general throughout the district. The last frost in the spring was on May 29 when 29·8° was recorded. The first frost in the fall was on August 28, when the mercury dropped to 29·8°. On August 6, a slight frost was experienced in some localities in the southern portion of the province, but at the Experimental Farm no effects of frosts could be observed on the tenderest foliage. The minimum temperature recorded for that day was 33·8°. Harvesting began on August 5, when two plots of winter wheat, some Mensury barley, and a plot of Riga wheat were cut. This was eleven days later than the first winter wheat was cut in 1908.

Undoubtedly the most disappointing feature of the season of 1909 to the farming interests of Southern Alberta was the almost complete failure of winter wheat, except in a few favoured localities. It is difficult to offer a satisfactory explanation for this quite general failure of what had begun to be considered a staple crop. To the dry fall, coupled with unfavourable conditions during the latter part of the winter and early spring, may be attributed much of the cause for the unsatisfactory condition of the winter wheat fields in the spring of 1909.

It must not be inferred, however, that the failure of the winter wheat to come through the winter in a desirable manner was the cause of any real loss to the district. As a matter of fact, the preparation that the land had received during the previous summer for the reception of the winter wheat left it in ideal condition to seed with spring grain, the result being that a large majority of the fields of spring grain that gave the greatest yields were resown winter wheat fields.

TWO FARMS.

Of the 400 acres on the Farm, one-fourth can be irrigated; the balance is devoted to 'dry' or non-irrigated farming. As stated in the last report, two Experimental Farms are really being operated at Lethbridge. Their object is, not to compare the relative merits of the two systems, but to study their individual problems. To aid in doing this and to prevent confusion, the report is divided into two parts. Part I. deals with the results from the non-irrigated or 'dry' farm, and Part II. with the results from the irrigated farm. In this connection, it might be well to point out that the yields of even the same variety of crop grown on the two farms in any one season are not necessarily comparable and that an increased yield on the irrigated portion may not be entirely due to irrigation, owing to the fact that the preparation of the land on the two fields may not have been identical.

Although nearly all of the tests carried out are the same on both the dry and the irrigated farms, still, it would be well for the reader, if he wishes to get a comprehensive grasp of the work, to read both parts. For example, any suggestions offered regarding the preparation of the land, particularly the raw prairie, in Part I., is equally applicable to the preparation of the land that is intended to be irrigated. Again the report of the trees and shrubs that have been tested so far on the Farm will be found in Part II., and any data in regard to their hardiness will apply to the same varieties if set out on non-irrigated land, providing the land has been properly prepared the year previous and intelligent cultivation is given.

PART I.—THE NON-IRRIGATED OR 'DRY' FARM.

EXPERIMENTS WITH WINTER WHEAT.

The results for the season with winter wheat have been quite disappointing for, both in the field lots and in the test plots, much winter-killing occurred, as is testified to by the low yields recorded below. The land on which all the wheat was sown was sod, broken during May and June, and was well-disced and harrowed, but not backset. The grain on the field lots and on a majority of the small plots barely showed above the ground, some of it hardly germinating in the fall, and, with the exception of the plots sown July 15, August 1 and 15, none of it started to stool.

One of the most interesting results from an experimental standpoint of the unusual season was the fact that out of nine varieties of winter wheat sown, only those of the Turkey Red type, or as it is commonly, though incorrectly, called here, Alberta Red, lived through. These nine varieties were sown on September 3, 1908,

in one-sixtieth acre plots at the rate of about forty-five pounds of seed per acre. The character of the soil is a sandy to a clay loam. The preparation of the land was the same for all winter wheat sown, both in plots and in field lots, being sod prepared as described above. These varieties all came up fairly well, but failed to stool to any extent in the fall. In the spring the only ones that were not dead were Kharkov and Turkey Red No. 380. These two are practically the same variety. Of these, only about fifty per cent of the stand was left and the vitality of the plants remaining seemed to be low, as indicated by the small amount of stooling that took place. No rust was observed. The seven varieties that killed out completely were, Abundance, Early Windsor, Prosperity, Red Velvet Chaff, Reliable, Dawson's Golden Chaff and Red Chief.

WINTER WHEAT—Test of Varieties (Non-irrigated).

Number of Plot.	Name of Variety.	Date of Ripening.	No. of Days Maturing.	Length of straw, including Head.	Character of Straw.	Length of Head.	Kind of Head.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				In.				Bush.	Lbs.	Lbs.
1	Kharkov........	Aug. 9.	340	30	Medium stiffness..	$2\frac{1}{2}$	Bearded	22	00	64
2	Turkey Red No. 380 (from Kansas)........	" 16.	347	34	" ..	$2\frac{1}{2}$	" .	14	30	65

FIELD LOTS OF WINTER WHEAT.

These fields were broken from the native prairie in June, 1908, but were not backset. They were sown the first part of September.

Variety.	Area.	Yield per Acre.	
	Acres.	Bush.	Lbs.
Kharkov..	2·7	22	45
"	1·0	24	00
"	13·9	16	47
Turkey Red No. 380..	4·1	23	55

WINTER WHEAT 'STUBBED' IN AFTER HARVEST.

On account of winter wheat not ripening early enough to be harvested before August, it is not practicable, after this grain is cut, to plough the land and reseed immediately, owing to the fact that the one crop must be cut and the next sown at the same season, or, to be more exact, in the same month. However, the question is often asked whether it would not be possible to run a seed drill immediately behind the binder and thus get the crop planted in time to catch any fall rains that might come. Although farmers at different times have attempted to carry out this plan, it has rarely been very profitable. To test this practice, a field of winter wheat was sown in September, 1908, at the rate of about 45 lbs. of seed per acre, after a crop of winter wheat had been harvested. No preparation of a seed-bed was attempted. The seed was sown with a single disc drill. The soil was dry at the time of seeding.

The crop yielded at the rate of 10 bushels and 20 pounds per acre.

WINTER WHEAT—DIFFERENT DATES OF SEEDING.

In studying the conditions that might influence winter killing, the experiment in which the winter wheat is sown at different dates is interesting. Results for the two years are here given.

The size of the plot used in 1908 was one-eighth of an acre and the variety was Turkey Red. In 1909, one-tenth acre plots were used and the variety was Kharkov. In both years the grain was sown on breaking, which was backset in 1908. but not in 1909.

WINTER WHEAT—Different Dates of Seeding.

Yield 1908.		Date of Sowing.	Date Ripe in 1909.	Yield 1909.		Average for Two Years.	
Bush.	Lbs.	1908		Bush.	Lbs.	Bush.	Lbs.
00	00	July 15	Aug. 10	6	00	00	00
00	00	Aug. 1	" 4	23	50	..	.
46	51	" 15	" 4	27	50	37	21
54	00	Sept. 1	" 16	26	20	40	10
38	48	" 15	" 15	6	30	27	39
38	00	Oct. 1	" 28	16	20	22	10
28	32	" 15	" 23	18	50	23	41
25	44	Nov. 1	" 23	14	10	19	57
12	16	" 15	" 23	11	10	11	43
11	20	Dec. 1	..	..	..	..	..

Studying the yields given in the table for 1909, it will be noted that the wheat sown on July 15 yielded but six bushels to the acre, and it should be mentioned that this plot came up well and made a vigorous growth before the winter set in. The next two dates of seeding, August 1 and 15, also made a good growth, but not quite so much as the first sowing. That sown on September 1 did not come up very well and practically no stooling took place. The increased yield from the plot sown October 15 is of interest, though rather difficult to explain. The wheat sown on this date germinated, but did not show above the ground, so it would indicate the importance of a farmer examining his winter wheat fields very carefully in the spring before reseeding. A very good way is to dig up a square foot of soil containing a drill row without disturbing the plants, late in March or early in April, and put it in a box in the house, where it should be kept moist. The manner in which the plants grow or fail to grow will allow one to gain some idea of their vitality. It is very reasonable to suppose that, though this plot sown on October 15 yielded less than nineteen bushels per acre, with more favourable conditions during April the yield might have been very materially increased.

WINTER WHEAT—RATES OF SEED PER ACRE.

The proper amount of winter wheat to sow per acre is a question that has provoked considerable discussion among the farmers in Southern Alberta for the past few years. The generally accepted opinion up to the present time has been that light seeding, by which is meant about three pecks to the acre, was best. But in discussing this matter during the past year with some of the best farmers in the district. the writer has been assured, by some of them at least, that they believe that somewhat heavier seeding would be wise. This idea is supported by the two years' tests that we have been able to carry out along this line, although the work of only two seasons is too brief to draw definite conclusions from. The following table gives the results for the past two years. The size of the plots in 1908 were one-eighth acre each; in 1909, one-tenth acre. The plots were sown September 4, 1908. and the variety used was Kharkov.

WINTER WHEAT—Rates of Seed per Acre.

Rate of Seed per Acre.	Date Ripe.	Yield in 1909.		Average for Two Years.	
Lbs.		Bush.	Lbs.	Bush.	Lbs.
15	August 17	16	40	33	20
30	" 16	31	00	42	30
45	" 16	37	00	46	54
60	" 14	51	40	55	26
75	" 12	54	20	57	46
90	" 12	52	40	56	28
105	" 12	42	00	51	24
120	" 12	44	00	52	00

In considering these tables it must be remembered that winter-killing occurred in all the 1909 plots, but, notwithstanding this, the fact that the results agree with those of the previous season is of interest.

EXPERIMENTS WITH SPRING WHEAT.

Although winter wheat yields more, under normal conditions, than does spring wheat, still, owing to a certain element of uncertainty that will always be connected with the wintering of wheat sown in the fall, together with the fact that it is possible to obtain a crop of spring grain the same season that it is sown, it is probable that the importance of spring wheat will never be second to winter wheat in Southern Alberta. Although our results on the Farm for the past season have been very satisfactory, the average was not as high as in the season of 1908. The quality was excellent.

SPRING WHEAT—TEST OF VARIETIES.

Fourteen varieties of spring wheat were sown on April 8 at the rate of about one bushel and one peck per acre in plots of one-sixtieth acre each. The land was sod, broken the previous May, but not backset. The character of the soil was a sandy to a clay loam. No rust was observed on any of the varieties.

SPRING WHEAT—Test of Varieties (non-irrigated).

Number of Plot.	Name of Variety.	Date of Ripening.	Number of days Maturing.	Length of Straw, Including Head.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				In.	In.		Lbs.	Bush.	Lbs.	Lbs.
1	Percy	Aug. 13	127	32	3	Beardless.	2,160	31	0	63
2	Preston	" 13	127	34	3	Bearded.	2,400	31	0	62
3	Marquis	" 12	126	33	2½	Beardless.	2,340	31	0	64
4	Red Fife	" 14	128	35	3	"	2,760	29	0	61
5	Chelsea	" 9	123	30	3	"	1,830	28	30	63
6	White Fife	" 14	128	35	3	"	2,310	28	30	62
7	Stanley	" 13	127	36	3½	"	2,250	28	30	62
8	Pringle's Champlain	" 12	126	32	3	Bearded.	2,040	28	0	62
9	Huron	" 13	127	30	3	"	2,280	27	0	62
10	Bishop	" 11	125	33	3	Beardless.	1,920	25	0	61
11	Hungarian White	" 9	123	28	3	Bearded.	1,860	25	0	62
12	Kubanka (durum)	" 13	127	38	2½	"	2,130	24	30	64
13	Gatineau	" 16	130	36	3½	"	2,100	23	0	60½
14	Riga	" 4	118	35	3	Beardless.	2,010	20	30	63

FIELD LOTS OF SPRING WHEAT.

On Backsetting.—A field of 4½ acres of Red Fife was sown May 4. It was cut August 23 and yielded at the rate of 27 bushels and 45 lbs. per acre.

On Fresh Breaking.—The temptation is very great to new settlers to break up land in the spring and sow it immediately with grain rather than to let the piece stand over the first summer after it is broken, to allow the sods to rot and to get a supply of moisture stored np in the sub-soil. The yield of oats, wheat or barley on land so treated is never very high, even in the most favourable year. The results this season from a field so handled are as follows. One and one-fourth acres of land were broken early in April about four inches deep, then rolled, double-disced twice, harrowed once between the discings and twice after. It was sown April 9 with Red Fife at the rate of about a bushel and a peck per acre. It was cut August 16 and yielded at the rate of only 10 bush. and 20 lbs. per acre.

EXPERIMENTS IN BREAKING VS. BREAKING AND BACKSETTING.

In May, 1908, a piece of raw sod land was broken about 3½ inches deep. Part of this was backset early in August, 2 to 2½ inches deeper than it was broken, and the remainder of the piece was merely disced thoroughly and harrowed during July. In April, 1909, both pieces were sown with Red Fife wheat at the rate of about a bushel and a peck to the acre. The two plots yielded as follows:—

FIRST CROP ON NEW LAND—Breaking *vs.* Breaking and Backsetting.

Area Acres.	——	Bush.	Lbs.
0.65	Yield per acre on land backset	30	31
0 87	" " not backset	25	40
	Increased yield per acre on land backset	4	51

In last year's annual report the results of an experiment similar to the above were given in which it was found that the average increase in yield due to backsetting with the three varieties of winter wheat then tested was 2 bushels and 8 lbs. per acre. Some of this same land was sown with spring wheat in 1909, to ascertain what effect the backsetting would have on the second crop of grain. After the winter wheat was cnt, nothing was done to the land until the spring, when part of it was double-disced and harrowed, and another part was ploughed early in April about 4½ inches deep and harrowed. Both pieces were sown with Red Fife wheat on April 9 at the rate of about one bushel of seed per acre. The following table gives the results obtained:—

SECOND CROP ON NEW LAND—Breaking *vs.* Breaking and Backsetting.

——	Ploughed in Spring.		Disced in Spring.		Average Yield from the two Fields.	
	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.
Yield per acre on land backset	20	50	17	40	19	15
" " not backset	16	40	17	58	17	19
Average increase of second crop from land backset					1	56

The average increase in yield of the second year's crop on the backsetting of 1 bush. and 56 lbs. added to the average increase in the yield of the winter wheat on the same land the year before of 2 bush. and 8 lbs. makes a total increase for the two years of 4 bush. and 4 lbs. per acre.

SPRING WHEAT—RATES OF SEED PER ACRE.

In the following experiment, the size of the plots used was one-twentieth acre each. They were sown April 16. The yields in all the plots are low for 1909, as the grain did not appear to stool well for some reason. The plots were put in on sod both years. In 1908, the land had been broken and backset the previous summer, in 1909, the land had been broken the previous May but had not been backset. The variety used both years has been Red Fife.

Spring Wheat—Rates of Seed per acre (non-irrigated.)

Rate of seed per acre.	Date Ripe.	Yield in 1909.		Average for two years.	
Lbs.		Bush.	Lbs.	Bush.	Lbs.
15	Aug. 27......	6	20	11	30
30	" 26......	12	40	18	20
45	" 23	19	40	24	30
60	" 23	21	20	26	0
75	" 22......	21	40	26	50
90	" 18......	22	20	27	20
105	" 18......	26	40	29	40
120	" 18... .	26	40	29	0

The above table is of considerable interest, even though it has been carried on but for two years. When we have had an opportunity of continuing this experiment for at least a year or two longer, the average results will be much more reliable.

COMMON EMMER.

On April 8 a one-sixth acre plot of Common Emmer was sown on land broken the previous May. The grain was ripe August 13. Number of days maturing, 127; length of straw including head, 27 inches; length of head, 2 inches; yield per acre of straw, 1,800 lbs.; of grain, 1,380 lbs.; weight per measured bushel, 50 lbs.

CULTURE OF WINTER AND OF SPRING WHEAT.

So many letters of inquiry concerning the growing of winter wheat and also of spring wheat are received at the Farm that it may be excusable to give a very brief outline of the general practice followed in the growing of these crops in Southern Alberta, even at the risk of repeating more or less of what was said in our last year's report. Anything in the way of preparation of the soil that will apply to spring wheat, is of course applicable to oats or barley.

PREPARATION OF SOD LAND.

The sod should be broken in May or in June, while the soil is moist and before the rainy season is over. May breaking usually gives better results than June breaking, the reason for this being that less of the rains is used up by the growing grass and, consequently, more is stored in the subsoil; also, the moist weather of June is conducive to the rotting of the grass roots. The sods should be rolled or flattened

down in some manner as fast as broken. This connects the furrow slice with the subsoil and facilitates the rotting process. The rolling should be done at noon and at night before the teams leave the field. If a tractor is used, a weighted roller should be attached behind the ploughs. The common practice is to break 3½ to 4½ or even 5 inches deep; after this, the surface cultivation should be shallow. No attempt should be made to cut through the sods with the discs, but merely to go deep enough to form a mulch on the top to prevent rapid evaporation. If one is prepared to do this surface cultivation after a rain, while the sods are moist, it will be found that the land is worked more economically and to much better advantage. Enough work should be done to get sufficient loose material to fill in the cracks between the sods which will then rot sufficiently during the summer to be loose and in good condition for growing a crop the following spring. It is generally found necessary, if a thorough job is desired, to double-disc the land twice, using a drag harrow and possibly a float after each double-discing. The latter is a contrivance made of four or five two-inch planks a foot wide, twelve to sixteen feet long, laid flatways and lapped so as to resemble somewhat a washboard. This implement, when weighted with stone or sod, added to the weight of the driver, crushes quite effectively small pieces of sod which, when dry, could not be broken up well with the drag harrow. The float should be followed immediately with a harrow, for evaporation takes place very rapidly from the land when the surface is left too smooth. If the floating is done just before seeding, the seed drill will, of course, roughen the surface. A light harrowing immediately after seeding is advisable.

For the best results with spring grain, this work should be done on the sod during the previous summer before the harvest. In this way, all the land requires in the early spring of the next year is a harrowing just as the frost draws out, to prepare it for the seed-drill.

SOWING ON FRESH BREAKING.

Considerable land during the past few years has been broken in April and immediately sown to grain. Although fair results are often obtained in this way, it is not a practice that can be recommended, for, if the season is dry, the resulting crop may be disappointing, and, on account of the sods not having had a chance to rot properly, the second crop is not nearly as good as the second crop after breaking the land in May or June and allowing it to lie fallow that summer as described above.

BACKSETTING.

Although it is not customary to backset in this district, it is a practice that cannot be too highly recommended. When backsetting is to be done, the sod should be broken as shallow as practicable and immediately rolled, or, if a roller is not available, it may be flattened down by a weighted float. The earlier the breaking after the grass has started growth, the better will be the results. In the latter part of July or early in August, if winter wheat is to be sown, the land is again ploughed (with stubble bottom ploughs) about two or three inches deeper than it was broken. The depth of this second ploughing should be governed in a measure by the depth of rotting that has taken place in the subsoil. In ordinary years, where the land has been broken in May or early in June, the grass roots for about two inches down in the subsoil have become rotted. If spring grain is to be sown, this second ploughing or 'backsetting' may be done any time in August or even in September when the sods and grass roots are better rotted, but, on the other hand, the land is apt to be a little drier at that time and consequently the soil is inclined to be too loose, which tends to make it dry out. This condition can be largely overcome by the use of a subsurface packer used at noon and at night before leaving the field. The packer should be immediately followed by a harrow. After backsetting, a seed bed can often be prepared by the use of a harrow only, but a disc should be used if the condition of

the ground requires it. Special attention should be called to the importance of harrowing each day's ploughing at night before leaving the field. If an engine is used, the harrow should be attached to the plough, or, if horses are used on a sulky or a gang plough, one section of a harrow should be attached so that the land is harrowed as fast as it is turned. This practice of harrowing land immediately after it is ploughed should always be followed; too much stress cannot be laid on this point.

It might be well to state here that backsetting is the only feasible way of preparing land that is to be used for a garden or for trees and shrubs the second season after a settler goes on raw land.

SUMMER-FALLOWING.

In speaking of this subject Mr. Angus McKay, Superintendent, Experimental Farm, Indian Head, puts in a concise way some of the advantages of summer-fallow, with special reference to its application to conditions in southern Saskatchewan, which are in so many ways similar to those found in southern Alberta, the one notable exception being that, so far, winter wheat has not been very successful there. He says:—

> Among the many advantages to the credit of the practice of summer-fallowing may be mentioned: The conservation of moisture, the eradication of weeds, the preparation of the land for grain crops at a time when no other work is pressing, the availability of summer-fallowed land for seeding at the earliest possible date in the spring and the minor advantages of having suitable land for the growing of pure seed, potatoes, roots and vegetables at the least cost and with the greatest chance for success, and that of being able to secure two crops of grain with little or no further cultivation.

Mr. Mackay adds, however:—

> 'Summer fallowing undoubtedly has some disadvantages, but, so long as the growing of grain, and more particularly wheat, remains the principal industry of the province, it will be necessary to store up moisture against a possible dry season, to restrain the weeds from over-running the land and, on account of the short seasons, to prepare at least a portion of the land to be cropped in the year previous to seeding and a well made summer-fallow is the best means to this end. Among the disadvantages are: The liability of the soil to drift, the over-production of straw in a wet season, causing late maturity and consequent danger of damage by frost, and it is claimed the partial exhaustion of the soil. The two former may, to a great extent, be overcome by different methods of cultivation, and, if the soil can be prevented from drifting, I am satisfied that one of the reasons for the latter contention will disappear.'

The growing of winter wheat in Southern Alberta gives an added reason why in that province, farmers should give summer fallowing even more careful consideration, if possible, than where spring wheat alone is raised. In this connection, summer fallowing certainly has a distinct advantage that is not mentioned in the quotation above for it must be admitted that there is a somewhat greater risk in getting a stand of winter wheat on sod than on well-prepared summer-fallow. In seasons like that of 1909, in which there was little or no precipitation during the months of August, September and October, it is very difficult to get the grain sown on fresh breaking. Although there is ample moisture in the subsoil, the sods themselves have become very dry and have not rotted sufficiently by August to allow the discs or shoes of the seed drill to cut through them so that the seed may be deposited on the moist subsoil. Under these conditions, opportune rains must be depended upon to bring the seed up. On well-prepared summer-fallow conditions are quite different, for, if the land is ploughed in May or June, while it is moist, before the rainy season is over and while the weeds are not more than a few inches high, little trouble is experienced

in getting the lower part of the furrow slice firm and keeping it moist. The depth of the ploughing should not be less than five or six inches and seven or eight is recommended, and a harrow should immediately follow. Too much stress cannot be laid on the importance of doing this ploughing early, *i.e.*, before the weeds have had a chance to grow large enough to pump out the moisture that should be stored in the subsoil for the crop that is to follow. If, for example, the weeds and volunteer grain are allowed to grow a foot or more high and it is necessary to use a chain on the plough to get them turned under, the work on the summer-fallow is practically thrown away, for the land is certain to turn up lumpy and loose and the supply of moisture that should be in the subsoil has already been heavily drawn upon.

If, after the land is ploughed, heavy rains form a crust, it should be broken up with a drag harrow before the land has had a chance to dry out to any extent. Sufficient surface cultivation should be given during the summer to prevent all weeds from growing, *i.e.*, the land should be kept perfectly bare. Two of the best tools to do this with are an ordinary harrow and a duck-foot cultivator. The latter implement is too rarely seen on the grain farms of Southern Alberta. A serious mistake is made when a disc is substituted, for the reason that it cuts down too much and so forms too deep a mulch. It also pulverizes the land excessively, causing it to drift too readily with the wind. The duck-foot cultivator can be set very shallow, just deep enough to cut off the small weeds and it merely loosens the surface without making it fine, leaving it in a granular rather than in a powdery condition. Another great advantage of the cultivator over the disc, that will appeal strongly to farmers, is that a summer-fallow may be cleaned much more economically with it. Whereas it is necessary to double-disc a piece of ground if a satisfactory job is to be accomplished, with this cultivator the same four horses will cover at least twice as much ground in a day and do the work better.

TIME TO SOW.

Winter Wheat.—Our results for the past two seasons certainly indicate that from the middle to the latter part of August is the best time to sow. On the other hand, it must be admitted that at the time of writing (March 31, 1910) the most promising fields throughout the southern portion of the province are, quite generally those that were sown last July. This is due to the great amount of moisture received from July 25 to 28. Up to the present time, a greater portion of the winter wheat sown is put in on new land so that the lack of our usual rains in August and September prevented the later sown grain from germinating. On well prepared summer-fallowed land, where it is possible to maintain the moisture zone relatively near the surface, we have reason to believe that August sowing will give more satisfactory results as a rule than will July sowing.

Spring Wheat.—Early sowing is of prime importance. Every effort should be made to conclude the seeding of this grain by May 1.

QUANTITY OF SEED TO SOW.

This, as well as the proper time to sow, is a point about which we have not yet sufficient data at hand to draw very satisfactory conclusions, consequently, any statements that are made in this connection must be considered as tentative. Sixty pounds of winter wheat and seventy to seventy-five pounds of spring wheat is probably a safe quantity to sow per acre.

HARROWING THE GROWING GRAIN.

It is a commendable practice to harrow the grain while it is young to break any crust, the result of heavy rains, and to form a mulch to aid in the retention of moisture.

SMUT.

Both winter and spring wheat seed should always be treated for smut. Either the formalin or the bluestone method is satisfactory, providing the work is done carefully. Very smutty grain should never be used for seed, for, even when treated thoroughly, some smut is apt to appear in the resulting crop. If seed wheat is treated every year whether any smut can be found in it or not, the trouble will be kept in subjection. With either method, it is important that each kernel be thoroughly wet. As to the strength of the solution, it should be strong enough to kill the smut spores, but not so strong as to injure the vitality of the grain. The strength of solution most often recommended is one pound of formalin to 32 gallons of water, and in the case of bluestone, one pound thoroughly dissolved in 6 gallons of soft water. The sacks into which the grain is to be put after it is treated should have been dipped in the solution also. In the case of formalin, it is the fumes that kill the spores, so, after the grain has been treated, it is a good plan to throw it into a heap and cover it with a canvas or with empty sacks, but see that the covering is free from smut spores.

EXPERIMENTS WITH OATS.

Twenty-one varieties of oats were sown on April 21, at the rate of about two bushels per acre in plots of one-sixtieth acre each. The land was sod, broken the previous May but was not backset. The character of the soil was a sandy to a clay loam. There was no rust in any of the varieties.

OATS—Test of Varieties (non-irrigated).

No. of Plot.	Name of Variety.	Date of Ripening.	No. of days Maturing.	Length of Straw including Head.	Length of Head.	Kind of Head.	Weight of Straw	Yield per Acre.		Weight per measured Bushel after Cleaning	Average Yield for Two Years.	
				Inches	Inch.		Lbs.	Bush	lbs	Lbs.	Bush	lbs
1	Improved American.....	Aug. 11	112	35	7	Branching	1,680	82	32	37½	84	7
2	Lincoln..................	" 9	110	35	6	"	900	97	2	40½	78	33
3	Banner..	" 9	110	30	6	"	1,860	56	16	40	68	13
4	Kendal White	" 11	112	33	6	"	2 280	65	10	39	67	22
5	Abundance	" 11	112	27	6	"	1,380	54	24	40	67	17
6	Golden Beauty	" 1'	112	30	5	"	2,130	60	30	40½	67	0
7	Irish Victor	" 9	110	33	6	"	2,040	58	8	41	66	6
8	Improved Ligowo.......	" 9	110	34	6	"	2,160	60	0	41½	61	1
9	Danish Island	" 9	110	32	6½	"	2,010	59	4	40½	65	20
10	American Triumph	" 12	113	34	6½	"	1,740	52	32	40	63	27
11	White Giant	" 9	110	32	6½	"	2,190	59	4	38½	61	16
12	Wide Awake.....	" 12	113	28	6	"	1,740	58	8	41	61	1
13	Twentieth Century . ..	" 10	111	32	5½	"	2,160	54	24	41	59	24
14	Siberian	" 12	113	35	6	"	1,920	54	24	39	57	7
15	Pioneer................	" 11	112	27	6	"	2,100	52	32	41	55	10
16	Milford White.....	" 12	113	32	7	sided	1,860	54	24	40	55	5
17	Virginia White....	" 9	110	31	6	Branching	1,650	50	10	41½	53	33
18	'Regenerated' Abundance	" 9	110	32	5½	"	1,350	52	2	..	..	..
19	Swedish Select	" 10	111	32	5½	"	1,560	47	22	43½	51	21
20	Thousand Dollar	" 10	111	30	6	"	1,980	45	30	42	50	25
21	Storm King	" 11	11:	31	6½	sided	1,620	44	4	39½	47	27

RATES OF SEED PER ACRE.

The size of the plots used was one-twentieth acre each and they were sown April 19. In 1908, the land used had been backset the previous summer, in 1909 it had been broken the previous May but had not been backset. The variety used in 1908 was Tartar King and, in 1909, Banner.

OATS—Rates of Seed per acre (non-irrigated.)

Rate of Seed per Acre.	Date Ripened.	Yield per Acre.		Average Yield per Acre for Two Years.	
Lbs.		Bush.	lbs.	Bush.	lbs.
15	August 17	40	20	40	0
30	" 16	58	8	54	24
45	" 14	64	4	58	28
60	" 12	65	10	62	32
75	" 12	62	32	59	14
90	" 12	61	26	62	12
105	" 9	63	18	62	2
120	" 9	61	6	58	18

EXPERIMENTS WITH BARLEY.

Ten varieties of six-rowed, and ten varieties of two-rowed, barley were sown May 6 at the rate of about one and one-half bushels per acre in plots of one-sixtieth acre each. The land was sod, broken the previous May but not backset. The character of the soil was a sandy to a clay loam. No rust was observed on any of the varieties.

SIX-ROWED BARLEY—Test of Varieties (non-irrigated).

No. of Plot.	Name of Variety.	Date of Ripening.		No. of days Maturing.	Length of Straw including Head.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
					Inches.	Inches.		Lbs.	Bush.	lbs.	Lbs.
1	Mansfield	Aug.	9	94	29	4	Bearded	1,260	48	36	52
2	Claude	"	9	95	27	2½	"	2,040	41	12	54
3	Odessa	"	9	95	26	3	"	1,980	41	12	51
4	Stella	"	11	97	30	2½	"	2,280	35	0	50½
5	Albert	"	5	91	32	4	"	1,800	33	36	50
6	Oderbruch	"	6	92	27	3½	"	1,560	33	36	51
7	Trooper	"	6	92	30	3½	"	2,080	33	36	49
8	Yale	"	9	95	27	2½	"	2,070	33	6	53
9	Mensury	"	4	90	30	4	"	1,590	31	42	49½
10	Nugent	"	10	96	27	3	"	1,920	31	12	49

TWO-ROWED BARLEY—Test of Varieties (non-irrigated)

No. of Plot.	Name of Variety.	Date of Ripening.		No. of days Maturing.	Length of Straw including Head	Length of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Clean'ng
					Inches.	Inches.	Lbs.	Bush.	lbs.	Lbs.
1	Canadian Thorpe	Aug.	13	99	24	2½	1,800	46	12	53
2	Swedish Chevalier	"	13	99	24	2½	2,580	43	36	53½
3	Invincible	"	14	100	24	3	2,400	40	00	53
4	Standwell	"	13	99	24	2½	1,920	35	00	52½
5	Clifford	"	13	99	30	3	2,220	31	12	53½
6	Gordon	"	9	95	32	2½	1,920	31	12	52½
7	French Chevalier	"	14	100	28	3	2,040	28	36	54
8	Jarvis	"	11	97	34	3½	2,400	28	36	54
9	Danish Chevalier	"	13	99	26	3	2,040	27	24	53
10	Beaver	"	11	97	28	3	2,100	25	00	52½

RATES OF SEED PER ACRE (NON-IRRIGATED).

The size of the plots used was one-twentieth acre each and they were all sown May 7. The land used had been broken the previous May but had not been backset. Only one year's results are given. The variety used was Mensury.

Rate of Seed per Acre.	Date. Ripened.	Yield.		Rate of Seed per Acre.	Date. Ripened.	Yield.	
Lbs.		Bush.	lbs.	Lbs.		Bush.	lbs.
15	Aug..... 17	1	12	75	Aug.... 13	32	44
30	" 17	2	44	90	" 9	34	8
45	" 17	20	0	105	" 7	35	40
60	" 17	25	20	120	" 7	35	20

WINTER BARLEY.

A plot of winter barley, from seed produced on the Farm in 1908, was sown September 3, 1908. Although a good stand was obtained in the fall, none was alive in the spring.

EXPERIMENTS WITH PEAS.

The yields obtained from field peas this year were again low, although slightly higher than they were last year. From some small tests that were carried out on the irrigated Farm, we feel that it is quite probable that the yields can be increased materially by inoculation. A description of this test of inoculating the soil for peas is given under 'Peas' in Part II of this report.

PEAS—Test of Varieties (non-irrigated).

Sixteen varieties of peas were sown April 22 at the rate of about two to two and a half bushels per acre, depending on the size of the pea, in plots of one-sixtieth acre each. The land was sod, broken the previous May but not backset. The character of the soil was a sandy to a clay loam.

PEAS—Test of Varieties.

No. of Plot.	Name of Variety.	Date of Ripening.	Number of Days Maturing.	Average Length of Straw.	Average Length of Pod.	Size of Pea.	Yield per Acre.	Yield per Acre.		Weight per measured Bushel after Cleaning
				Inches.	Inches.		Lbs.	Bush.	Lbs.	Lbs.
1	Victoria............	Aug. 17..	117	30	2½	Large.....	1,530	25	30	63½
2	Picton............ .	" 11..	111	34	2½	"	1,320	22	00	64
3	Mackay.........	" 13..	113	28	3	"	1,320	22	00	64
4	Prussian Blue ..	" 11..	111	28	2½	Medium..	1,290	21	30	65
5	Daniel O'Rourke ...	" 10..	110	30	2	Small	1,290	21	30	63½
6	Prince	" 11..	111	26	2	Medium..	1,230	20	30	63½
7	Paragon.....	" 13	113	24	2½	" ..	1,200	20	00	64
8	White Marrowfat...	" 13..	113	32	3	Large	1,170	19	30	63¾
9	Early Britain,......	" 10..	110	29	2	"	1,050	17	30	63
10	Golden Vine	" 9..	109	27	2	Small	1,050	17	30	64½
11	Wisconsin Blue.. ..	" 13..	113	27	2½	"	1,020	17	00	64¼
12	Black-eye Marrowfat	" 17..	117	26	2	Large.....	1,020	17	00	
13	Chancellor	" 9..	109	33	2	Small	990	16	30	
14	Gregory	" 18..	118	25	2½	Medium..	960	16	00	63¾
15	Arthur	" 11..	111	24	2	" ..	960	16	00	63¼
16	English Grey......	" 11..	111	28	2½	" ..	930	15	30	64½

WINTER RYE.

A small field of winter rye was sown September 12, 1908, at the rate of about one bushel per acre. The land had been broken in May of that year but had not been backset. A good stand was obtained in the fall, but it did not stool a great deal. Some winter-killing occurred so that there was only a fair stand of grain in the spring.

It was ripe August 9. The height including head was 53 inches. Size of field 0·55 acres and the yield was at the rate of 24 bushels and 19 lbs. per acre.

EXPERIMENTS WITH INDIAN CORN.

The vacant or open land in Southern Alberta is being fenced up very rapidly, in fact, already there are districts where one would have to go for miles in any direction to find even a quarter section unfenced. Although settlers could depend on getting upland hay from this vacant land a few years ago, the time is now at hand when they will have to produce what hay they require on their own farms. Corn, cut green and cured in the stook, makes an excellent substitute for hay especially for cows and young stock of all kinds. Our short season does not allow any but the small-growing and extremely early varieties to ripen, but, if the land is properly prepared, varieties that will not ripen grain will produce a large amount of fodder per acre.

To get the best results, corn should be planted on land in which the sods have been thoroughly rotted. Very new land does not, usually, give good returns. There is no crop that appreciates stable manure more than corn, provided the manure is rotted and has become well incorporated into the soil.

TEST OF VARIETIES.

Seventeen varieties of corn were planted May 27 on sod land that had been broken the previous May and backset in September. In the early spring of 1909, manure from the Canadian Pacific Railway stockyards was applied at the rate of about twelve loads per acre and was then ploughed under. The condition of the land was not the most desirable, as the sods were not well rotted and as a result, the ploughing of the land in the spring to cover the manure left the soil too open and loose. This, doubtless, accounts in a large measure for the low yields given in the following table. Two rows of each variety were planted in hills with three feet between rows, and another two rows of each variety planted with the seed a few inches apart in the row. They were all cut September 8. The yield of green fodder per acre in each case was computed from two rows each 66 feet long.

INDIAN CORN—Test of Varieties (non-irrigated).

No. of Plot.	Name of Variety.	Weight per Acre grown in Rows.		Weight per Acre grown in Hills.	
		Tons.	lbs.	Tons.	lbs.
1	Champion White Pearl	7	1,730	4	1,900
2	Early Mastodon	6	430	5	780
3	Selected Leaming	6	430	4	580
4	Compton's Early	6	100	4	1,680
5	Longfellow	5	1,880	5	1,000
6	Eureka	5	1,550	4	800
7	Salzer's All Gold	5	1,440	4	1,460
8	North Dakota White	5	1,330	4	800
9	Mammoth Cuban	5	1,220	4	360
10	Wood's Northern Dent	5	780	4	910
11	Angel of Midnight	5	450	4	30
12	Superior Fodder	4	1,680	3	1,370
13	Triumph	4	580	3	1,370
14	Mercer	4	470	3	930
15	Northwestern Dent	3	1,700	3	1,590
19	White Cap Yellow Dent	3	1,700	3	600
17	Davidson	2	1,170	2	1,170

EXPERIMENTS WITH TURNIPS.

Two varieties of turnips were tested. The preparation of the soil, a sandy to a clay loam, was the same as that for the Indian corn which is described above. They were planted in rows 30 inches apart and the yield in each case was computed from two rows each 66 feet long. Two sowings were made, the first on May 20 and the second on June 3. Both sowings were pulled on October 13.

TURNIPS—Test of Varieties (non-irrigated).

Number.	Name of Variety.	Yield per Acre. 1st Plot.		1st Plot.		2nd Plot.		2nd Plot.	
		Tons.	lbs.	Bush.	lbs	Tons.	lbs.	Bush.	lbs.
1	Hall's Westbury	9	480	308	00	7	520	242	00
2	Halewood's Bronze Top	3	1,920	132	00	4	580	143	00

EXPERIMENTS WITH MANGELS.

Ten varieties of mangels were tested. The preparation of the soil, a sandy to a clay loam, was the same as that for the Indian corn which is described above. They were planted in rows 30 inches apart and the yield in each case was computed from two rows each 66 feet long. Two sowings were made in each case, the first on May 10 and the second on May 25. The mangels were all pulled on October 13.

MANGELS—Test of Varieties (non-irrigated).

Number.	Name of Variety.	Yield per Acre, 1st Plot.		Yield per Acre, 1st Plot.		Yield per Acre, 2nd Plot.		Yield per Acre, 2nd Plot.	
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.
1	Selected Yellow Globe	13	1,456	457	36	6	1,860	231	00
2	Half Sugar White	13	400	440	00	8	1,160	286	00
3	Mammoth Red Intermediate	12	420	407	00	3	600	110	00
4	Giant Yellow Globe	11	1,760	396	00	8	1,160	286	00
5	Prize Mammoth Long Red	11	1,100	385	00	8	1,160	286	00
6	Perfection Mammoth Long Red	11	1,100	385	00	7	1,840	264	00
7	Gate Post	11	440	374	00	6	1,200	220	00
8	Yellow Intermediate	10	1,120	352	00	6	1,200	220	00
9	Crimson Champion	10	460	341	00	7	1,840	264	00
10	Giant Yellow Intermediate	9	1,800	330	00	6	1,200	220	00

EXPERIMENTS WITH CARROTS.

Five varieties of carrots were tested. The preparation of the soil, a sandy to a clay loam, was the same as that for the Indian corn, which is described above. They were planted in rows 20 inches apart and the yield in each case was computed from two rows each 66 feet long. Two sowings were made in each case, the first on May 10 and the second on May 25. The carrots were all pulled on October 13.

CARROTS—Test of Varieties (non-irrigated.)

Number.	Name of Variety.	Yield per Acre, 1st Plot.		Yield per Acre, 1st Plot.		Yield per Acre, 2nd Plot.		Yield per Acre, 2nd Plot.	
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.
1	Mammoth White Intermediate	8	830	280	30	5	1,880	198	..
2	Ontario Champion	8	830	280	30	3	930	115	30
3	White Belgian	6	1,860	231	..	2	1,940	99	..
4	Improved Short White	5	890	181	30	5	1,286	188	6
5	Half-Long Chantenay	3	930	115	30	5	296	171	36

EXPERIMENTS WITH SUGAR BEETS.

Four varieties of sugar beets were tested. The preparation of the soil, a sandy to a clay loam, was the same as that for the Indian corn which is described above. They were planted in rows 20 inches apart and the yield in each case was computed from two rows, each 66 feet long. Average specimens of roots from each variety were sent to the Chemist of the Experimental Farms, Mr. Frank T. Shutt, carefully wrapped in oil paper to prevent, as much as possible, the loss of moisture. He made a determination of the per cent of sugar in the juice, the results of which are given in the last three columns of the table. Two sowings of each variety were made, the first on May 10 and the second on May 25. The roots were all pulled on October 13.

SUGAR BEETS—Test of Varieties (non-irrigated).

Number.	Name of Variety.	Yield per Acre, 1st Plot.		Yield per Acre, 2nd Plot.		Sugar in Juice.	Solids in Juice.	Co-efficient of Purity.
		Tons.	Lbs.	Tons.	Lbs.	p. c.	p. c.	p. c.
1	Vilmorin's Improved	11	1,760	4	910	17·05	19 69	86·6
2	French, Very Rich	9	810	3	1,920	17·78	20·23	87·8
3	Klein Wanzleben	6	1,860	5	890	17·44	20·29	85 9
4	Klein Wanzleben (Raymond Seed)	....	....	4	1,900	21·17	23·49	90·1

EXPERIMENTS WITH POTATOES.

Nineteen varieties of potatoes were tested. The preparation of the soil, a sandy to a clay loam, was the same as that for the Indian corn which is described above. The sets were planted May 21 in rows two and one-half feet apart and about a foot apart in the rows. They were all dug on October 11 and the yield in each case was computed from two rows, each 66 feet long. No rot was observed in any of the varieties.

POTATOES—Test of Varieties (non-irrigated).

Number.	Name of Variety.	Average Size.	Total Yield per Acre.		Yield per Acre. Marketable.		Yield per Acre. Unmarketable.		Form and Colour.
			Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	
1	Empire State................	Small.......	198	0	92	24	105	36	Oval, white.
2	Late Puritan..................	Medium....	182	36	114	24	68	12	"
3	Vick's Extra Early.............	Small.......	172	42	99	0	73	42	Irregular, pink.
4	Rochester Rose................	"	169	24	103	24	66	0	Oval, pink.
5	Gold Coin......................	Medium....	165	0	121	0	44	0	Round & oval, white
6	Holborn Abundance............	Small.......	162	48	103	24	59	24	Round, white.
7	Reeves' Rose..................	Medium....	160	36	79	12	81	24	Oval, pink.
8	Morgan Seedling...............	Small.......	160	36	83	36	77	0	Irregular, pink.
9	Irish Cobbler..................	Medium....	159	30	110	0	49	30	Round, white.
10	Carman No. 1..................	"	158	24	110	0	48	24	Oval, white.
11	State of Maine................	"	149	36	94	36	55	0	Oval & round, white
12	American Wonder.............	Small.......	149	36	81	24	68	12	Oval, white.
13	Money Maker..................	Medium...	148	30	93	30	55	0	Flat, oval.
14	Dreer's Standard..............	Small.......	148	30	103	24	45	6	Round, white.
15	Ashleaf Kidney................	"	138	36	92	24	46	12	Oval, white.
16	Everett........................	Medium....	136	24	55	0	81	24	Oval, pink.
17	Early Manistee................	"	129	48	72	36	57	12	Flat, round, pink.
18	Dooley.........................	Small.......	123	12	72	36	50	36	Round, white.
19	Dalmeny Beauty...............	Medium....	74	48	30	48	44	0	" "

ALFALFA OR LUCERNE.

Several plots of alfalfa were sown on backsetting, without a nurse crop, in the spring of 1908. The plants were clipped off once during the summer and were left on the ground, but the growth was not large. Our results from these dry-land plots this season have been quite encouraging, as will be noted from the following table. The weights given are for the cured hay as it was hauled into the barn. The first cutting was made June 28 and the second cutting was made August 13. Size of each plot, one-fourth acre, part of which was inoculated in 1908 and the balance of each plot was left untreated.

ALFALFA—(non-irrigated).

Amount of seed per Acre.	Inoculated. First Cutting.	Inoculated. Second Cutting.	Inoculated. Total for Season.	Not Inoculated. First Cutting.	Not Inoculated. Second Cutting.	Not Inoculated. Total for Season.
Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
5	5,355	980	6,335	4.320	630	4,950
10	5,425	875	6,300	3,285	468	3,755
15	4,690	980	5,670	3,375	360	3,735
20	3,955	980	4,935	3,015	495	3,510

Average yield per acre of the four plots for the season, 5,810 lbs., inoculated; 3,988 lbs., not inoculated.

The average increase in yield for the season, due to inoculation, was 1,822 lbs. per acre.

From the table two interesting points are brought out: First, that the plots where the seed was sown at the rate of 5 and 10 pounds per acre yielded heavier than those where the seed was sown at the rate of 15 to 20 lbs. to the acre. It should be mentioned that on the irrigated Farm the results were just the reverse, *i.e.*, the plots receiving the lightest seeding gave the smallest yields of hay. The proper amount of alfalfa seed to sow on non-irrigated land has not yet been determined accurately, but ten or eleven pounds to the acre is probably not far from correct. In this experiment, five pounds to the acre gave the best results, but it must be borne in mind that it was sown under most favourable conditions, as the seed bed was in exceptionally fine condition and opportune rains followed so that all the seeds had a good chance to germinate and grow.

The second point of particular interest brought out by the table, is the large increase, amounting on the average to nearly a ton to the acre during the season, in the crop obtained from the portion of the plot that had been inoculated with soil from an old alfalfa field in the spring of 1908, when the seed was sown. Many farmers are under the impression that it is necessary to inoculate the land to get a good stand of young alfalfa, but this is not the case. The seed comes up quite as well on land that is not inoculated as on land that is. The second season, however, the effect of inoculation is noticeable, for on land not treated the plants almost invariably become less thrifty, as indicated by their yellowish or light green appearance, and do not usually assume a normal vigorous growth until the end of perhaps the third season.

That the hay problem is one that is confronting every farmer on non-irrigated land in Southern Alberta is quite freely admitted and it is certainly worth his while to give it careful consideration. Alfalfa is without doubt the most promising forage plant that has been tested so far, and every farmer should give it a careful trial. One hundred pounds of inoculated alfalfa soil will be supplied gratis to any farmer in Southern Alberta who will apply to this Farm for it, the recipient paying the freight from Lethbridge. A circular dealing quite fully with alfalfa growing will be mailed free to any one who will apply for it.

Some alfalfa was planted in the spring of 1908, in rows 28 inches apart, which was cultivated twice with an ordinary garden cultivator during the summer of 1908. It was planted in this maner with a view of raising seed. A small plot on one side of this plot was cut for hay this summer. Two crops were obtained. The first yielded at the rate of two tons 140 pounds per acre and the second yielded a few pounds less than a ton to the acre or a total for the season of three tons 120 pounds per acre. The yield of seed from that allowed to ripen was about 90 pounds per acre. Even this light yield at the present high price of the seed (and there is little likelihood of it being much cheaper), makes a profitable crop. Further investigations along this line are being carefully carried out. A larger area consisting of about 3¾ acres was sown in June, 1909, in rows for the production of seed next year, and an excellent stand was obtained.

About 6 acres of new land was seeded down with alfalfa in the ordinary way on June 12 and a good stand was obtained.

CLOVER.

A small plot of Red clover was planted in May, 1908, without a nurse crop on backsetting. It was cut July 28, 1909, and yielded at the rate of 1,600 pounds per acre. A plot of Alsike clover planted at the same time and in the same way yielded at the rate of 900 pounds per acre. There was a small amount of winter-killing in both of these plots. White clover, planted under the same conditions in 1908, winter-killed very badly and there was not enough left to make it worth while cutting this year.

BROME GRASS.

One-half acre of Brome grass was planted in the spring of 1908 on backsetting. One cutting was made July 28, 1909, which yielded at the rate of one ton and 1,050 pounds per acre.

WESTERN RYE GRASS.

One-half acre of Western Rye grass was planted in the spring of 1908 on backsetting. One cutting was made July 28, 1909, which yielded at the rate of two tons and 250 pounds per acre.

TIMOTHY.

One-quarter acre of timothy was planted under the same conditions as the above grasses. It was cut July 28, 1909, and yielded at the rate of one ton and 440 pounds per acre.

SUMMARY OF CROPS GROWN EXCLUSIVE OF UNIFORM TEST PLOTS (NON-IRRIGATED.)

	Bush.
Winter wheat	471
Spring wheat	267
Oats	201
Barley	22
Rye	13
	974

	Tons.
Hay, mixed	6¼
Oats, cut green for feed	8
Native hay from uncultivated area	5
	19¼

SMALL FRUITS (NON-IRRIGATED.)

In the spring of 1909, permanent plantations of red, white and black currants, gooseberries and raspberries were set out. The currants and gooseberries were set 6 feet apart each way. The raspberries were planted in double rows which were seven feet apart and the plants were set three feet apart in the row. Most of the plants put out established themselves well. The following list gives the names of the varieties and the number of each set out. All the raspberries were bent over and covered with earth before winter set in.

RED CURRANTS.

Number set Out.	Variety.	Number set Out.	Variety.
3	New Red Dutch.	2	Victoria Red
1	Fay's Prolific.	3	Red Grape.
3	Raby Castle.	3	Greenfield.
3	La Conde.	2	Rankin's Red.
1	Col. Wilder.	2	Cumberland.
3	Long Bunch Holland.	2	Red English.
3	Large Red.	1	Frauendorfer.
2	Moore's Seedling.		

WHITE CURRANTS.

3	Kaiser.	3	Large White.
3	Verrier's White.	3	Large Brandenburg.
3	White Cherry.	3	White Grape.
3	White Pearl.	3	Wentworth Leviathan
3	Climax.	2	White Dutch.

BLACK CURRANTS.

3	Topsy.	3	Success.
3	Eclipse.	3	Merveille de la Gironde.
3	Ethel.	3	Saunders.
3	Ontario.	3	Bang Up.
3	Magnus.	3	Climax.
3	Beauty.	3	Winona.
3	Monarch.	3	Eagle.
3	Norton.	3	Kerry.

GOOSEBERRIES.

3	Pearl.	3	Whitesmith.
3	Downing.	3	Smith's Improved.
3	Red Jacket.		

RED RASPBERRIES.

10	Early King.	10	Sunbeam.
10	Sarah.	10	Herbert.
8	Marlborough.	8	Cuthbert.
11	London.		

BLACK CAPS.

10	Kansas.	8	Cumberland.

BLACKBERRIES.

10	Eldorado.	10	Snyder.
10	Shaffer's Colossal (violet),		

APPLE ORCHARDS (NON-IRRIGATED).

The following is a list of the varieties of apples and the number of each sort set out in the spring of 1908. In the second column, the number living in the summer of 1909 is given.

CROSS BREDS.

Variety.	Number Set.	Number alive in 1909.	Variety.	Number Set.	Number alive in 1909.
Aurora	2	1	Norman	4	4
Bow	4	2	Novelty	2	2
Carleton	1	1	Pioneer	4	2
Charles	2	1	Prince	4	2
Cowley	2	1	Progress	2	1
Eve	2	1	Robin	4	2
Jewel	4	3	Silvia	4	2
Magnus	4	4	Tony	4	2
Mecca	2	2			

SEEDLINGS OF CROSS-BREDS.

Alberta	5	2	Eva	5	2
Betty	5	2	Golden	5	3
Bow	3	3	Magnus	5	4
Charles	5	3	Pioneer	3	3
Cowley	5	5	Robin	5	1
Dawn	5	2	Sylvia	4	4
Elsa	4	4	Tony	5	3

STANDARDS AND CRABS.

Alexander	1	1	Longfield	2	1
Arcola	2	1	Lowland Raspberry	2	2
Baxter	1	1	Lyman Crab	2	2
Beaver	2	2	Melinda	2	2
Bison	2	2	Marmalade	1	1
Bomba	2	2	McIntosh Red	2	2
Bowie	2	1	McMahon White	2	2
Calumet	1	1	Mentor	1	1
Canadian Baldwin	1	1	Melfort	1	0
Carlisle	2	2	Milwaukee	2	2
Charlamoff	2	2	Minnesota Hybrid	2	2
Cottage	2	1	Murillo	2	2
Crescent	1	1	Nestor	1	0
Dart	2	1	Okabena	2	1
Dauphin	1	1	Osler	1	1
Dewar	2	1	Otter	2	2
Duchess	3	3	Panoka	2	2
Dudley	2	2	Parma	2	2
Earliana	2	2	Patten's Greening	2	2
Early Strawberry	2	2	Peerless	2	2
Excelsior Crab	2	2	Ramosa	1	0
Florence	2	2	Roslin	2	2
Galena	1	1	Rupert	4	4
Grand St. Jean	1	1	Scott's Winter	3	3
Hanley	2	2	Simbirsk	4	4
Hare Pipka	1	0	Stone	2	1
Hibernal	4	3	Sugar Miron	2	2
Hyslop Crab	2	2	Transcendent	2	2
Jasper	1	1	Wealthy	4	4
Lubsk Queen	2	2	Wesley	1	1
Langford Beauty	3	3	Whitney Crab	4	4
La Victoire	4	4	Winter Rose	2	2
Lead of St. Petersburg	2	2	Wolf River	2	2
Leroy	1	0	Yellow Transparent	2	2

NEW VARIETIES SET OUT IN 1909.

One specimen each of three new cross-breds, Sampson, Fairfield, Rideau.

PART II.—THE IRRIGATED FARM.

WINTER WHEAT.

No winter wheat was tested this season under irrigation.

EXPERIMENTS WITH SPRING WHEAT.

Five varieties of spring wheat were sown on April 26 at the rate of about one and one-half bushels to the acre in plots of one-sixtieth acre each. The land was broken the previous June but was not backset. The character of the soil was a sandy to a clay loam. The plots were irrigated once, on July 10. No rust was observed.

SPRING WHEAT—Test of Varieties (irrigated).

No. of Plot.	Name of Variety.	Date of Ripening.	No. of days Maturing.	Length of Straw including Head.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Inches	Inches		Lbs.	Bush.	Lbs.	Lbs.
1	Percy A	August 20	116	36	3	Beardless	2,460	43	0	65
2	Preston	" 20	116	36	2½	Bearded	2,940	41	0	64
3	Huron	" 17	113	34	3	"	2,580	39	0	65
4	Red Fife H ..	" 20	116	32	2½	Beardless	1,980	37	0	64
5	Stanley	" 17	113	38	3	"	3,580	34	0	63

SPRING WHEAT—RATES OF SEED PER ACRE.

In the following experiment, the size of the plots used was one-twentieth acre each; they were sown April 16. The plots were put in on sod both years. In 1908, the land had been broken and backset the previous summer; in 1909, the land had been broken the previous June but had not been backset. The variety used both years has been Red Fife. One irrigation was given, on July 10.

SPRING WHEAT—Rates of Seed per acre (irrigated).

Amount of Seed.	Date of Ripening.	Yield 1909.		Average Yield for two Years.	
Lbs.		Bushel	Lbs.	Bushels	Lbs.
15	August 28	35	0	32	30
30	" 26	29	20	32	30
45	" 23	33	20	33	55
60	" 23	29	20	34	40
75	" 23	36	0	38	0
90	" 22	38	0	38	25
105	" 22	38	40	38	15
120	" 22	38	30	34	25

The high yield of 35 bushels obtained this season from 15 pounds of seed is probably caused by some exceptional condition in the soil of the plot, as this amount is so at variance with the other yields.

SEED SELECTION EXPERIMENT.

To test the possibility of breeding a strain of Red Fife wheat that could be grown on irrigated land and yet be more free from the 'yellow berry' than at present, the following experiment was inaugurated. In May, 1909, fifty kernels of Red Fife were carefully selected, showing no trace of 'yellow berry' and at the same time ten kernels were selected that showed a decidedly starchy appearance. These were planted in the garden on well fertilized soil and in a place where they would be wet whenever any portion of the garden was irrigated. They were planted in rows three feet apart and each kernel was placed six to eight inches apart in the rows. Thorough cultivation was given the plants during the summer. Forty-seven out of the fifty selected kernels produced plants and, of the ten 'yellow berries' planted, nine plants were obtained. Of the forty-seven, three plants ripened August 30, twenty-six on September 2, and eighteen on September 11. The other set of nine plants ripened about the same time.

Each plant was harvested by itself when the majority of the heads were ripe, and was stored away in the barn but, unfortunately, mice damaged all the plants more or less. However, some seeds were threshed from each plant.

Of the lots of grain from the forty-seven plants, grown from seed free from 'yellow berry,' fifteen showed the presence of 'yellow berries' while in thirty-two none could be found. Of the nine plants grown from seed composed of kernels that would be called 'yellow berries,' five showed the presence of yellow berries, while in four none could be found. Expressed in per cent:—

Seed free from 'yellow berry' produced 32 per cent 'yellow berry' kernels.

Seed not free from 'yellow berry' produced 56 per cent 'yellow berry' kernels.

This would indicate that, by selecting seed from only those plants which produce no 'yellow berries,' one could, in time, breed a strain that would be less apt to produce 'yellow berries' under conditions conducive to the production of this less desirable quality in the grain. On account of the mice destroying so much of the grain, it was impossible to get an idea of the yields from the various plants, consequently, in selecting seed for the season of 1910, a preference was given to those plants which ripened earliest, although at least two kernels were taken from each of the twenty plants that were ripe by September 2 and which produced no 'yellow berries' and none were saved from those which ripened September 11.

EXPERIMENTS WITH OATS.

Six varieties of oats were sown on April 23 at the rate of about two bushels and two pecks per acre in plots of one-sixtieth acre each. The land was broken the previous June, but was not backset. The character of the soil was a sandy to a clay loam. The plots were irrigated once, on July 10. No rust was observed.

OATS—Test of Varieties (irrigated).

No. of Plot.	Name of Variety.	Date of Ripening.	No. of days Maturing.	Length of Straw including Head.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Inches			Lbs.	Bush.	lbs.	Lbs.
1	Improved American..	August 17	116	38	6½	Branching	3,060	90	0	41
2	Irish Victor..	" 16	115	34	6½	"	2,580	82	32	43
3	Abundance ..	" 19	118	35	5½	"	2,400	79	14	42½
4	Banner..	" 19	118	34	6	"	2,580	77	22	40
5	'Regenerated' Abundance.	" 17		36	5½	"	2,550	75	0	
6	Danish Island	" 16	115	32	6	"	2,340	72	12	40
7	Sixty Day. ..	" 10	109	30	5½	"	1,740	63	18	

OATS—FIELD LOTS.

A field of 15½ acres was broken from the prairie sod in June of 1908 and during that summer was double-disced twice and harrowed. Banner oats were sown this year at the rate of 95 pounds of seed per acre. The seeding began April 26, but, owing to a storm, could not be finished till May 4. The grain was irrigated once between July 12 and 15. The field was ripe August 21 and yielded at the rate of 70 bush. and 17 lbs. per acre.

One acre of land prepared in just the same manner as described for the above field, was divided and one-half of it was sown with Garten's 'Regenerated' Abundance oats on May 4 at the rate of 110 pounds of seed per acre. The other half-acre was sown with Banner oats on May 5 at the rate of 95 lbs. of seed per acre. One irrigation was given on July 12. Both fields ripened at the same time and were cut August 20. Garton's 'Regenerated' yielded at the rate of 58 bushels and 28 pounds per acre, and Banner oats at the rate of 77 bushels and 22 pounds per acre.

OATS—RATE OF SEED PER ACRE.

In the following experiment, the size of the plots used was one-twentieth acre each; they were sown April 16. The plots were put in on sod both years. In 1908, the land had been broken and backset the previous summer; in 1909, the land had been broken the previous June, but had not been backset. The variety used the first season was Tartar King and this season Banner. One irrigation was given, on July 10.

OATS—Rates of Seed per Acre (irrigated).

Amount of Seed.	Date Ripe.	Yield in 1909.		Average for two Years.	
Lbs.		Bushels	Lbs.	Bnshels	Lbs.
15	August 26	91	0	75	27
30	" 22	89	14	70	20
45	" 17	84	24	73	8
60	" 17	87	22	78	18
75	" 17	88	8	81	16
90	" 16	93	18	78	28
105	" 16	94	4	81	6
120	" 16	82	12	74	14

EXPERIMENTS WITH BARLEY.

Four varieties of six-rowed and two varieties of two-rowed barley were sown on May 7 at the rate of about one bushel and three pecks per acre, in plots of one-sixtieth acre each. The land was broken the previous June, but was not backset. The character of the soil was a sandy to a clay loam. The plots were irrigated once during the season, on July 10. No rust was observed.

SIX-ROWED BARLEY—Test of Varieties (Irrigated).

No. of Plot.	Name of Variety.	Date of Ripening.	No. of days Maturing.	Length of Straw, including Head.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Inches.	Inches.		Lbs.	Bush.	Lbs.	Lbs.
1	Claude. ..	Aug. 16	101	32	$2\frac{1}{2}$	Bearded	2,340	63	36	57
2	Odessa.......	" 16	101	30	2	"	1,980	61	12	56
3	Mansfield ...	" 16	101	34	2	"	1,980	58	36	56
4	Mensury....	" 13	98	32	$2\frac{1}{2}$	"	2,220	53	36	54

TWO-ROWED BARLEY—Test of Varieties (Irrigated).

No. of Plot.	Name of Variety.	Date of Ripening.	No. of days Maturing.	Length of Straw, including Head.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Inches.	Inches.		Lbs.	Bush.	Lbs.	Lbs.
1	Swedish Chevalier......	Aug. 19	104	31	3	Bearded	2,400	68	36	57
2	Standwell....	" 17	102	33	2	"	2,700	64	18	57

FIELD LOTS OF BARLEY.

A field of one and one-eighth acres of Mensury barley was sown on May 7 at the rate of about two bushels per acre, on sod land, broken in June, 1908, but not backset. The field was irrigated once on July 13 and was ripe August 14. It yielded at the rate of 42 bushels and 2 pounds per acre.

BARLEY—RATE OF SEED PER ACRE.

In this experiment, the size of the plots used was one-twentieth acre each, they were sown May 7. The land was sod, broken in June, 1908, but not backset. They were irrigated once, on July 11.

MENSURY BARLEY—Rates of Seed per Acre (Irrigated).

Amount of Seed.	Date of Ripening.	Yield, 1909.		Average for 2 Years.	
lbs.		Bush.	Lbs.	Bush.	Lbs.
15	Aug. 17	40	20	36	12
30	" 17	44	28	40	0
45	" 17	45	20	41	22
60	" 17	46	32	43	6
75	" 13	51	12	44	8
90	" 9	47	24	43	16
105	" 7	42	24	38	26
120	" 7	47	24	41	12

EXPERIMENTS WITH PEAS.

Sixteen varieties of peas were sown on April 23 in plots of one-sixtieth acre each at the rate of about two to two and a half bushels to the acre, depending on the size of the pea. The land was broken the previous June, but was not backset. The character of the soil was a sandy to a clay loam. The plots were irrigated once during the season, on July 10.

PEAS—Test of Varieties (Irrigated).

No. of Plot.	Name of Variety.	Date of Ripening.	Number of days Maturing.	Average Length of Straw.	Average Length of Pod.	Size of Pea.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Inches.	Inches.		Bush.	Lbs.	Lbs.
1	Wisconsin Blue.. ...	Aug. 24..	123	40	2½	Small..	31	0	64½
2	Daniel O'Rourke . ..	" 19 .	118	36	2½	"	28	30	64½
3	Gregory..............	" 31 .	130	50	3	Medium.. ..	24	0	64
4	Golden Vine	" 17..	116	34	2	Small......	23	30	64½
5	Early Britain...... .	" 19..	118	34	3	Large	23	0	63
6	English Grey..........	" 19..	118	32	2	Medium.. ..	19	30	64½
7	Chancellor............	" 11..	111	32	2	Small.......	19	30	64½
8	Arthur	" 11..	111	30	2	Medium.. ..	19	30	65¼
9	Paragon	" 28..	127	36	2	" ...	18	30	62½
10	White Marrowfat.. . .	" 30..	129	32	2½	Large	17	0	63
11	Mackay...	" 24..	123	30	2½	"	16	30	64¼
12	Black-eye Marrowfat..	" 24 .	123	36	3	"	15	0	
13	Prince...............	" 17..	116	30	2	Medium.. ..	13	30	64
14	Victoria	" 28.	127	30	2	Large	13	0	64
15	Picton...............	" 19..	118	33	2	"	12	0	64½
16	Prussian Blue.........	" 17..	116	30	2½	Medium.. ..	11	0	65¼

INOCULATION FOR PEAS.

The yields of peas, for the two seasons that they have been tested on this Farm, have not been at all satisfactory. The growth of the vines has not appeared to be as vigorous as would be expected from the fertile condition of the soil in which the peas have been planted. To ascertain what effect, if any, inoculation of the seed or the soil in which the peas were planted would have, the following test was carried out. A small bottle of nitro-culture for peas was supplied by Mr. Shutt, the Chemist of the Experimental Farms, and a few pounds of soil in which peas had been grown the previous season was obtained from the Brandon Experimental Farm and also from a farm near Kingston, Ont. Some of this inoculating material was received late in the season so the plots were not planted till June 9. The peas were sown broadcast and raked in. Failing to get sufficient rain to bring the seed up, it was necessary to flood-irrigate it, which caused the surface soil to bake badly, consequently the young plants had a poor start and were too late to ripen seed. Very small plots were used and they were not of uniform size; however, they were large enough to allow the character of growth to be easily observed. Before irrigating, a bank of earth was thrown up around each plot 8 or 10 inches high and only enough water was allowed on each plot at one time to cover it three or four inches deep. None of the water from one plot was allowed to reach any of the other plots in order to prevent any possibility of carrying the inoculating bacteria in the water from one plot to another. By the time the plants were 10 inches to a foot high, there was a decided difference in the colour of the foliage between the plots treated and the untreated check-plot. In the latter part of September the vines were cut and the yields of these when cured is given in the following table:—

Prussian Blue Peas—Inoculation test (Irrigated).

Plot No.	——	Area.	Weight of cured Vines.	Yield per acre of cured Vines.	Increase per acre in Yield over Check Plot.
		Acres.	Lbs.	Lbs.	Lbs.
1	Check-plot untreated..	1/193	25	2,325	
2	Culture from Ottawa..	1/403	10	4.030	1,705
3	Soil from Brandon..............	1/189	25	4,725	2,400
4	Soil from Ontario..	1/195	22	4,290	1,965

It is unfortunate that the crop was so late that seed could not mature, so that the actual increase in yield could be determined, but the marked difference in the weights of vines between plots treated and the check plot left untreated is significant. The results are sufficiently encouraging to warrant one in expecting encouraging results along this line in tests that are planned for the season of 1910.

EXPERIMENTS WITH INDIAN CORN.

Although abundant yields of alfalfa hay may be obtained from irrigated land, still, corn raised for fodder, to be used in the green state to supplement the dry pastures of August and September where milch cows are kept, or to be cured in the shock and fed later in the dry condition or to be stored in a silo, is of much importance on account of the fact that corn fodder, fed in conjunction with alfalfa hay, gives a much better balanced ration than this hay fed alone. Especially is this the case for milch cows. Again, if the supply of alfalfa is limited, a large quantity of rough feed can be produced economically by planting corn on well-prepared land

Indian Corn—Test of Varieties.

Seventeen varieties of Indian corn were planted May 26 on land from which a crop of seedling Caraganas had been raised in 1908. During the winter, manure from the Canadian Pacific Railway stockyards was applied at the rate of about twelve loads per acre and was ploughed under in the spring. The soil was a sandy to a clay loam. Two rows of each variety were planted in hills with three feet between rows, and another two rows of each variety planted with the seed a few inches apart in the row. The crop was irrigated on July 20 and on August 23. The varieties were all cut September 7. The yield of green fodder per acre in each case was computed from two rows, each 66 feet long.

Indian Corn—Test of Varieties (Irrigated).

Number	Name of Variety.	Height.	Leafiness.	Condition when Cut.	Weight per acre grown in Rows.		Weight per acre grown in Hills.	
		Inches.			Tons.	Lbs.	Tons.	Lbs.
1	Early Mastodon....	64	Extra good .	In silk..........	15	1,130	8	1,600
2	Superior Fodder	58	" .	Barely in silk...	12	1,850	8	1,380
3	Mammoth Cuban...........	60	" .	Tasselled.......	12	1,300	6	430
4	Compton's Early	66	Good.......	In silk..........	11	1,430	8	830
5	Eureka	63	"	"	10	1,780	6	1,200
6	Longfellow.....	66	Fair....... .	Very early milk.	10	1,560	6	1,200
7	Salzer's All Gold.....	50	Extra good .	Tasselled........	9	700	6	430
8	Selected Leaming...........	58	Medium	Barely in milk..	9	700	6	430
9	Angel of Midnight	60	"	In silk..........	9	150	7	630
10	White Cap Yellow Dent.....	60	Extra good..	"	8	1,600	4	1,680
11	Wood's Northern Dent......	60	Fair.. .. .	"	8	1,600	6	1,750
12	Triumph........	58	"	Starting to silk.	8	1,160	7	1,730
13	North Dakota White	60	Medium....	In silk..........	8	830	7	630
14	Champion White Pearl......	55	"	Starting to silk..	7	1,400	7	300
15	Mercer.....	60	"	Tasselled.....	7	630	8	1,050
16	Northwestern Dent	65	Poor to fair.	In silk..	6	650	6	430
17	Davidson..................	58	Medium ...	"	6	320	5	340

EXPERIMENTS WITH FIELD ROOTS.

Under irrigation, it is possible to obtain very large yields of all kinds of roots, especially if a proper rotation is followed coupled with the judicious use of manure. The preparation of the land in which the roots were planted was just the same as that of the Indian corn, *i.e.*, manure from the Canadian Pacific Railway stockyards was applied during the winter at the rate of about twelve loads to the acre and was ploughed under in the spring.

EXPERIMENTS WITH TURNIPS.

TEST OF VARIETIES.

Eleven varieties were tested on a sandy to a clay loam, and two plantings of each were made, the first on May 20 and the second on June 3. The rows were 30 inches apart and the young plants were thinned to about ten or twelve inches apart in the row. The crop was irrigated five times, on July 6, 17, 20, 26, and on August 4. The yield in each case was computed from the weight of roots from two rows, each 66 feet long. They were all pulled on October 10.

TURNIPS—Test of Varieties (Irrigated).

Number.	Name of Variety.	Yield per Acre, 1st Plot.		Yield per Acre, 1st Plot.		Yield per Acre, 2nd Plot.		Yield per Acre, 2nd Plot.	
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.
1	Mammoth Clyde....	25	160	836	0	14	380	473	0
2	Skirving's...	24	840	814	0	16	1,660	561	0
3	Halewood's Bronze Top.	23	860	781	0	15	1,680	528	0
4	Perfection Swede....	21	1,560	725	0	9	1,800	330	0
5	Carter's Elephant	21	240	704	0	12	420	407	0
6	Kangaroo...	20	1,580	693	0	15	1,020	517	0
7	Jumbo	20	920	682	0	13	400	440	0
8	Hall's Westbury...	19	280	638	0	10	460	341	0
9	Magnum Bonum	18	960	616	0	12	1,080	418	0
10	Good Luck.	16	1,000	550	0	12	420	407	0
11	Bangholm Selected...	16	340	539	0	12	24	400	24

MANGELS.

TEST OF VARIETIES.

Ten varieties were tested on a sandy to a clay loam, and two plantings of each were made, the first on May 8 and the second on May 25. The rows were 30 inches apart and the young plants were thinned to about ten to twelve inches apart in the row. The crop was irrigated five times on July 6, 17, 20, 26, and on August 4. The yield in each case was computed from the weight of roots from two rows, each 66 feet long. They were all pulled on October 8.

Mangels—Test of Varieties (Irrigated).

Number.	Name of Variety.	Yield per Acre, 1st Plot.		Yield per Acre, 1st Plot.		Yield per Acre, 2nd Plot.		Yield per Acre, 2nd Plot.	
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.
1	Half Sugar White	24	840	814	0	15	1,284	521	24
2	Gate Post	23	200	770	0	17	1,640	594	0
3	Crimson Champion	22	880	745	0	13	1,060	451	0
4	Mammoth Red Intermediate	22	220	737	0	15	96	501	36
5	Giant Yellow Intermediate	21	900	715	0	15	1,020	517	0
6	Giant Yellow Globe	20	920	682	0	14	1,700	495	0
7	Yellow Intermediate	18	300	605	0	16	1,792	563	12
8	Perfection Mammoth Long Red	17	1,640	594	0	13	1,060	451	0
9	Prize Mammoth Long Red	17	1,640	594	0	12	1,344	422	24
10	Selected Yellow Globe	16	340	539	0	15	1,020	517	0

Carrots.

TEST OF VARIETIES.

Five varieties were tested on a sandy to a clay loam, and two plantings of each were made, the first on May 8 and the second on May 25. The rows were 20 inches apart and the young plants were thinned to about six inches apart in the rows. The crop was irrigated five times, on July 6, 17, 20, 26, and August 4. The yield in each case was computed from the weight of roots from two rows each 66 feet long. They were all pulled on October 8.

Carrots—Test of Varieties (Irrigated).

Number.	Name of Variety.	Yield per Acre, 1st Plot.		Yield per Acre, 1st Plot.		Yield per Acre, 2nd Plot.		Yield per Acre, 2nd Plot.	
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.
1	Ontario Champion	14	1,700	495	0	5	1,880	198	0
2	Half Long Chantenay	13	1,720	462	0	7	850	247	30
3	White Belgian	12	750	412	30	7	1,018	250	48
4	Improved Short White	12	750	412	30	6	870	214	30
5	Mammoth White Intermediate	6	1,860	231	0	1	1,564	59	24

Sugar Beets.

TEST OF VARIETIES.

Four varieties were tested on a sandy to a clay loam, and two plantings were made of the first three on May 10 and on May 25. Only one planting was made from the seed obtained from Raymond, on May 25. The rows were 20 inches apart and the young plants were thinned to about six inches apart in the row. The crop was irrigated five times, on July 6, 17, 20, 26, and on August 4. The yield in each case was computed from the weight of roots from two rows, each 66 feet long. Average specimens of roots from each variety was sent to the Chemist of the Experimental Farms Mr. Frank T. Shutt, Ottawa, carefully wrapped in oil paper to prevent, as much as possible, any loss of moisture. The results of his analysis in regard to the per cent of

sugar in juice is given in the last three columns of the table. They were all harvested on October 8.

SUGAR BEETS—Test of Varieties (Irrigated).

Number.	Name of Variety.	Yield per Acre, 1st Plot.		Yield per Acre, 1st Plot.		Yield per Acre, 2nd Plot.		Yield per Acre, 2nd Plot.		Sugar in Juice.	Solids in Juice.	Co-efficient of Purity.
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.	p. c.	p.c.	
1	Klein Wanzleben	24	1,500	825	0	21	1,560	726	0	17·74	19·49	91·5
2	French, Very Rich.......	24	510	808	30	19	1,600	660	0	17·64	19·17	92·0
3	Vilmorin's Improved ..	24	520	808	30	17	1,640	594	0	18·59	20·24	91·8
4	Klein Wanzleben (Raymond Seed).	....		....		18	630	610	30	17·68	19 69	89·7

EXPERIMENTS WITH POTATOES.

TEST OF VARIETIES.

Twenty varieties were planted on a sandy to a clay loam on May 21. The rows were 30 inches apart and the sets were placed about a foot apart in the rows. The crop was irrigated four times, on July 17, 26, August 4 and 24. They were dug on October 11 and the yield in each case was computed from the weight of potatoes obtained from two rows each 66 feet long. There was no rot observed in any of the varieties.

POTATOES—Test of Varieties (Irrigated).

Number.	Name of Variety.	Average Size.	Total Yield per Acre.				Yield per Acre. Marketable.		Yield per Acre. Unmarketable		Form and Colour.
			Tons.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	
1	State of Maine.	Large	19	808	646	48	638	0	8	48	Oval, white.
2	Empire State	"	18	1,092	618	12	598	24	19	48	Long "
3	Irish Cobbler.....	"	18	300	605	0	572	0	33	0	Flat "
4	Morgan Seedling.	Medium. .	17	244	587	24	572	0	15	24	Long, pink.
5	American Wonder......	Large	17	56	567	26	539	0	28	36	" white.
6	Rochester Rose..........	Medium. .	15	1,284	521	24	484	0	37	24	" pink.
7	Money Maker............	Large ...	15	1,020	517	0	499	24	17	36	Round, white.
8	Vick's Extra Early	Medium. .	15	624	510	24	466	24	44	0	Flat "
9	Late Puritan.........	Large ...	13	1,588	459	48	429	0	30	48	Long, pink.
10	Holborn Abundance	Medium. .	13	268	437	48	385	0	52	48	Round, white.
11	Everett...	Large	12	1,608	426	48	385	0	41	48	Long, pink.
12	Dreer's Standard	" ..	12	1,344	422	24	396	0	26	24	Oval, white.
13	Dalmeny Beauty.........	" ...	12	288	494	48	360	48	44	0	"
14	Early Manistee..........	Medium. .	12	156	402	36	369	36	33	0	Flat, pink.
15	Gold Coin...	Large ...	11	308	371	48	358	36	13	12	Round, white.
16	Carman No. 1.	"	11	176	369	36	352	0	17	36	Flat "
17	Ashleaf Kidney..........	"	11	176	369	36	338	48	30	48	Oval "
18	Reeve's Rose	Medium. .	10	856	347	36	308	0	39	36	Long, pink.
19	Dooley..	Large	8	1,160	286	0	264	0	22	0	Round, white.
20	Uncle Gideon's Quick Lunch	Medium. .	6	804	213	84	184	48	23	36	" pink.

FORAGE CROPS (IRRIGATED).

ALFALFA OR LUCERNE.

Alfalfa is, without doubt, the most profitable field crop that has yet been raised on irrigated land in Southern Alberta, and every owner of such land should make a strenuous effort to get in a large acreage as soon as possible. Space will not be taken up here to give any details iu regard to the growing of this plant, but a circular dealing with the matter quite fully will be mailed free to any one applying for the same.

On account of not having any old land, it was not thought advisable to plant a very large acreage of alfalfa in the season of 1908, but in the latter part of May of that year a few acres were sown. One of the experiments was to determine the best quantity of seed to sow per acre. The following table gives the results obtained during the season of 1909. It would be only fair to mention that a fine staud was obtained, as, just after sowing, very timely rains came and practically every seed grew, which is a condition that cannot be always relied upon. This should be borne in mind in studying the results. The plots were irrigated on July 3 to 5 after the first cutting was made, again on August 12 to 14 after the second cutting was made, and in the fall between October 1 and 4 to insure plenty of moisture being in the ground through the winter and in the spring.

ALFALFA—Rates of Seed (Irrigated).

Rate of Seed sown.	1st Cutting June 24.		2nd Cutting Aug. 4.		3rd Cutting Sept. 13.		Total Yield for Season.	
Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
5	1	1,840	2	1,000	1	220	5	1,060
10	2	200	2	1,280	1	1,040	6	520
15	2	680	2	1,480	1	1,180	6	1,340
20	2	200	2	1,680	1	1,220	6	1,100
25	2	0	2	1,400	1	1,280	6	680
30	2	280	2	1,520	1	1,200	6	1,000

The second cutting was not cured quite as dry as it might have been before it was hauled to the barn, consequently the yield on the second cutting for all of the plots is a trifle high. As mentioned above, an extremely good stand was obtained on account of the timely rains and of the seed bed being in such an ideal condition. As a rule, such conditions cannot be relied upon, so five or ten pounds of seed do not always give as good a stand as was here obtained. Observation and experience in this district would indicate that twenty pounds of seed on irrigated land is about the correct amount to sow.

ALFALFA—EXPERIMENTS WITH INOCULATION.

When the alfalfa was sown in May, 1908, the land was all inoculated except a small piece left untreated for a check plot, and the following table gives the effect of this use of soil from au old alfalfa field spread over the land just previous to sowing the seed. These plots were irrigated at the same time as the Rates of Seed plots were.

ALFALFA—Inoculation Tests (Irrigated).

	1st Cutting June 24.		2nd Cutting Aug. 4.		3rd Cutting Sept. 13.		Total Yield for Season.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Inoculated.........	2	700	2	50	1	1,050	5	1,800
Uninoculated......		1,900	1	1,050	1	800	3	1,750
Increase due to inoculation..........							2	50

It might be well to call attention to the fact that an equally good stand was obtained on both these plots, whether they were inoculated or not, as the inoculation rarely affects the growth of the plants until the second season. When the last cutting was made, but little difference was noted in the colour and general appearance of the two pieces and it is anticipated that the piece that is uninoculated will be quite as good as the other next spring, because the irrigation water will have distributed the germs over the untreated plots.*

MIXTURES OF ALFALFA AND GRASSES.

Where alfalfa is sown with a mixture of grasses such as timothy, rye grass, &c., the hay can be cut only twice during the season instead of three times, owing to the fact that the grasses are not ready to cut until sometime in July, which allows time for only one more cutting to come on, while alfalfa when grown alone must be cut about the 25th of June if three cuttings are desired. After the grasses have been cut in July, they make little growth, so that the second cutting is practically pure alfalfa. The following table gives the results of three plots of one-quarter acre each, sown in 1908. They were irrigated three times during the season, on July 3 to 5, August 12 to 14, and October 1 to 4, the last to provide moisture for the winter.

MIXED HAY (irrigated).

	1st Cutting July 19.		2nd Cutting August 30.		Total Yield for Season.	
	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.
Alfalfa and Timothy..................	1	1,620	1	920	3	540
Alfalfa and Rye Grass	1	1,800	1	1,840	3	1,640
Alfalfa, Timothy and Rye Grass..	1	1,940	2	440	4	380

NEW SEEDINGS OF ALFALFA.

Seed of fourteen varieties or strains of Alfalfa was received from the United States Department of Agriculture, Washington, D.C. These were supplied by the courtesy of Mr. J. M. Westgate, Agronomist, Division of Forage, Crop Investigations.

* As stated in Part I., one hundred pounds of inoculated alfalfa soil will be supplied gratis to any farmer in the southern part of the province from the Lethbridge Experimental Farm. The recipient must pay freight charges.

They were sown without a nurse or cover crop on June 5 at the rate of about 20 pounds of seed per acre, in one-tenth and one-fortieth acre plots, depending on the amount of seed, except the *Medicago falcata*, of which there was only an ounce or so. A good stand was obtained on all the plots. The following is a list of the varieties, giving, as well, the climates of the regions where some of the more recent kinds were obtained.

VARIETIES OF ALFALFA.

Size of Plot. — Acre.	Number and Name.	Size of Plot. — Acre.	Number and Name.
1–10	25102 Grimm.	1–40	22783 from Tschimkent, Turkestan, average winters.
1–10	21032 Turkestan.		
1–10	23454	1–40	22790 from Khiva, Turkestan, mild winters.
1–10	23396 Sand Lucerne.		
1–10	23394 " "	1–40	23203 from Werny, Turkestan, very severe winters.
1–10	24836 Canadian (Purple Flowers).		
1–10	24837 " (Variegated).	1–40	22788 from Aulieata, Turkestan, severe winters.
1–10	24859		
1–40	25022 Old Frankish Lucerne.	1–300	24452 *Medicago falcata* (Yellow flowered).

It might be of interest to note that the last named alfalfa, the *falcata*, is a distinct species from the ordinary sort. It is quite hardy and, doubtless, the natural hybrids between this and the common purple flowered kind produce the hardy strains such as the Grimm, Sand Lucerne and others. The falcata itself is not valuable for hay on account of its stems not having an upright growth, but rather a tendency to lie prostrate or procumbent. However, in any portions of the province where ordinary alfalfa does not prove to be hardy, it is quite probable that some form of hybrid may be found that will be so. One of the easiest ways of recognizing one of these hybrids is in the variegated colourings of the blooms.

FIELD LOT OF ALFALFA (irrigated).

The last of May a field of about four acres was sown without a nurse crop at the rate of 20 pounds of seed per acre and a good stand was obtained.

TIMOTHY. *(Phlarum pratonse).*

A quarter-acre plot of this hay was sown in 1908. Part of it was given a light top-dressing of coarse, strawy manure in November, 1908, and the difference in the resulting yields is quite marked. The dates of irrigation for this plot are the same as for the plots of Alfalfa. The crop was cut July 19.

	Yield per acre. Tons.	Lbs.
Timothy top-dressed the previous fall	2	40
Timothy not top-dressed	1	1,200
Difference in yield		840

BROME GRASS. *(Bromus inermis).*

A half-acre plot was sown in 1908. Part of it was top-dressed the same as the timothy and it was also irrigated and cut at the same time as the former.

	Yield per acre. Tons.	Lbs.
Brome Grass top-dressed the previous fall	2	440
Brome Grass not top-dressed	2	0
Difference in yield		440

WESTERN RYE GRASS. *(Agropyrum tenerum).*

A half-acre plot was sown in 1908. Part of it was top-dressed the same as the brome and timothy plots. It was irrigated and cut at the same time they were.

	Yield per acre. Tons.	Lbs.
Western Rye grass top-dressed the previous fall	2	40
Western Rye grass not top-dressed	2	320
Difference in yield		290

SUMMARY OF CROPS GROWN EXCLUSIVE OF UNIFORM TEST PLOTS (IRRIGATED).

	Bush.
Wheat (spring)	35
Oats	1,383
Barley	82
	1,500

	Tons.
Hay, mixed	19
Oats, cut green for feed	4
Native hay from uncultivated area	4
	27

SMALL FRUITS (IRRIGATED).

In the spring of 1909, permanent plantations of red, white and black currants, gooseberries and raspberries were set out. The currants and gooseberries were set six feet apart each way. The raspberries were set in double rows which were seven feet apart and the plants were set three feet apart in the row. Most of the plants put out established themselves well. The following list gives the names of the varieties and the number of each set out. All the raspberries were bent over and covered with earth before winter set in. The plantation was irrigated early in July and again in October after growth had ceased. This last irrigation was to supply moisture for the winter.

RED CURRANTS.

Number set out.	Variety.	Number set Out.	Variety.
3	Champagne.	3	Pomona.
3	Cumberland.	3	Prince Albert.
3	Fay's Prolific.	3	Rankin's Red.
3	Frauendorfer.	3	Red English.
3	Greenfield.	3	Red Grape.
3	La Conde.	3	Red Dutch.
3	Large Red.	3	Raby Castle.
3	Long Bunch Holland.	3	Victoria Red.
3	Moore's Seedling.	3	Col. Wilder.
3	New Red Dutch.		

WHITE CURRANTS.

3	Verrier's White.	3	White Grape.
3	Wentworth's Leviathan.	3	White Kaiser.
3	White Brandenburg.	3	White Pearl.
3	White Cherry.	3	Large White.

BLACK CURRANTS.

3	Climax.	3	Magnus.
3	Eagle.	3	Merveille de la Gironde.
3	Kerry.	3	Monarch.
3	Lee's Prolific.	3	Ontario.
3	Norton.	3	Saunders.
3	Bang-Up.	3	Success.
3	Beauty.	3	Topsy.
3	Eclipse.	3	Winona.
3	Ethel.		

GOOSEBERRIES.

2	Carman.	3	Red Jacket.
1	Companion.	3	Smith's Improved.
3	Downing.	3	Whitesmith.
3	Pearl.		

RED RASPBERRIES.

12	Cuthbert.	12	Ruby Red.
10	Early King.	20	Sarah.
20	Herbert.	40	Sunbeam.
26	Loudon.	16	Golden Queen (yellow).
12	Marlboro.		

BLACK CAPS.

12	Cumberland.	10	Kansas.
5	Hilborn.		

BLACKBERRIES.

7	Conrath.	10	Snyder.
14	Eldorado.	10	Shaffer's Colossal (purple).

STRAWBERRIES.

A plantation of strawberries was set out in the spring of 1908. In the fall of that year there were some plants living of each of thirty-six different varieties. Two rows each 50 feet long were laid off for each sort but, owing to the fact that many of the plants were in a poor condition when received last year, an indifferent stand of most of the varieties was obtained, so that the yields this season from the

various sorts are of so little value as a basis of comparison that they are omitted. The plantation was mulched with straw during the winter. Thirty-five varieties fruited. The first fruit ripe was on the Beder Wood on July 4. On the 9th, pickings were made from the following varieties: August Luther, Wm. Belt, Ruby, Carrie, Fountain, Clyde and Senator Dunlap. Apparently, the Beder Wood and August Luther were the earliest varieties this season. The stands were too poor to gain a very satisfactory idea of the best yielding late sorts. One of the most promising varieties for general planting among those tested is the Senator Dunlap. This is a perfect-flowering sort and is a vigorous, strong grower. As there are plenty of young plants of all varieties that established themselves to set out a fresh plantation of the same size in 1910, it is hoped that a good even stand may be obtained when this is done, so that the relative yields, together with notes concerning their season, quality, &c., under our conditions, may be obtained.

APPLE ORCHARDS (IRRIGATED).

The following is a list of the varieties of apples and the number of each set out in the spring of 1908. In the second column the number living in the summer of 1909 is given.

CROSS BREDS.

Variety.	Number set Out.	Number alive in 1909.	Variety.	Number set Out.	Number alive in 1909.
Bow	4	3	Norman	4	3
Golden	1	1	Osman	1	1
Jewel	4	2	Pioneer	4	2
Josie	2	2	Robin	6	4
Kent	5	1	Silvia	6	4
Magnus	4	3	Tony	4	2

SEEDLINGS OF CROSS-BREDS.

Alberta	5	5	Golden	5	2
Betty	2	1	Madge	1	1
Bow	5	..	Magnus	3	3
Charles	5	4	Martha	1	1
Cowley	3	3	Pioneer	4	2
Dawn	3	2	Prince	5	4
Eva	3	2	Robin	5	3
Elsa	5	2	Tony	5	5

STANDARDS.

Arcola	2	..	Longfield	1	1
Bowie	2	..	Melinda	2	2
Charlamoff	2	..	McIntosh Red	2	1
Cottage	2	..	McMahon White	2	..
Dart	2	1	Milwaukee	3	3
Duchess	2	1	Panoka	2	2
Dudley	1	1	Patten's Greening	1	1
Early Raspberry	1	1	Robin	2	2
Excelsior Crab	2	2	Scott's Winter	2	1
Hanley	2	2	Stone	1	1
Hilborn	2	2	Transcendent Crab	1	1
La Victoire	2	2	Winter Rose Crab	2	2
Lead of St. Peterburg	1	1	Yellow Transparent	2	2

TREES AND SHRUBS (IRRIGATED.)

The following trees and shrubs were set out in the spring of 1907 in nursery rows and brief notes are given concerning their condition in the summer of 1908 after passing through the first winter and in 1909 after going through the second winter.

Reference Number.	No. set Out.	Name.
		Acer (Maple).
319½	2	A. pictum ruhrum '09, all alive but killed back about half.
320	4	A. platanoides purpurea, '09, one alive and it only at the roots.
321	2	A. platanoides Schwedleri '09, only one alive, killed back.
319	6	A. saccharinum '08, four alive, killed back; '09, still alive, hut killed to ground.
398	10	A. tataricum '08, thrifty; '09 tips killed back.
341	10	A. tataricum Ginnala '09, thrifty, perfectly hardy.
		Amelanchier (June Berry).
442	2	A. vulgaris '09, thrifty.
		Aristolochia (Birthwort).
1355	4	A. Sipho '08, dead.
		Artemisia (Southernwood).
1313	4	A. Abrotanum '09, starts from the base each season, thrifty.
		Berberis (Barberry).
501	6	B. Aquifolinm '09, killed ⅔ back.
1206	2	B. canadensis '09, about half killed back.
1114	3	B heteropoda '08, 1 alive; 09, ⅔ killed back.
895	30	B. Thunbergi '09, partly killed back.
		Betula (Birch).
18	18	B alha, (white Birch), dead in '08.
385	4	B. alha laciniata pendula (Cut-leaved Weeping Birch) '08, thrifty; '09, hardy.
343	6	B. lutea, (Yellow Birch) '07, dead in fall.
		Calycanthus (Carolina Allspice).
1386	10	C. floridus '08, only two alive; '09, dead.
		Caragana (Siberian Pea Tree).
394	20	C. aborescens '08, thrifty; 09, thrifty
	75	C. frutescens all living in '09, perfectly hardy.
836	6	C. mollis glabra '08, five alive; '09, thrifty.
569	2	C. Redowsky '09, hardy and thrifty.
912	4	C. pygmaea '09, thrifty.
571	1	C. spinosa '08, thrifty; '09, tips killed.
		Catalpa.
1504	6	C. Kaempferi '08, alive; '09, dead.
1010	4	C. speciosa '08, alive; '09, three alive at base.
		Celastrus (Shrubby Bitter-Sweet).
1550	1	C. scandens '08, killed back, '09; alive at base.
		Clematis (Virgin's Bower).
1406	6	C. integrifolia cærulea '08, 4 alive; '09, growing from base.
433	6	C. Vitalba '08, thrifty; '09, 4 alive and thrifty.
376	4	C. Viticella '08, 3 alive; '09, growing from base.

TREES AND SHRUBS (IRRIGATED)—*Continued.*

Reference Number.	No. set Out.	Name.
		Cornus (Dogwood).
515	10	C. alba sibirica variegata '08, 8 alive ; '09, growing from base.
996	6	C. purpusa '08, alive ; '09, badly killed back.
490	6	C. Spaethii aurea '08, 3 alive ; '09 killed to base.
		Cotoneaster.
834	2	C. acutifolia '08, 1 alive ; '09, killed half back.
477	2	C. bacillaris '09, 1 killed half back, other killed to base.
916	2	C. frigida '08, 1 alive ; '09, killed $\frac{2}{3}$ back.
396	2	C. nigra '08, dead.
407	2	C. tomentosa '08, 1 alive ; '09, very thrifty.
988	2	C. vulgaris '09, $\frac{1}{3}$ killed back.
		Crataegus (Hawthorn).
1251	4	C. Carrièri '07, 1 dead ; '08, killed back ; '09, alive at base.
1256	4	C. Arnoldiana '09, thrifty.
1223	3	C. Apiosa '07, 1 dead ; '08, killed to base ; '09, only one left and almost dead.
972	4	C. coccinoides '08, killed back slightly ; '09, $\frac{2}{3}$ killed back.
947	2	C. collina '08, 1 alive ; '09, alive at base.
932	2	C. fecunda '08, dead.
905	3	C. spathulata '08, 2 killed back ; '09, alive at base only.
1238	2	C. submollis '09, quite thrifty.
		Cytisus (Broom).
1260	2	C. hirsutus '09, killed back.
380	4	C. nigricans '07, 2 alive ; '09, growing from base.
1055	2	C. triflorus '08, 1 alive ; '09, alive at base.
		Elaeagnus (Olive).
19	20	E. angustifolia (Russian Olive) one dead fall of '07 ; in '08, 2 dead and all killed back more or less ; '09, tips killed back.
930	1	E. umbellata '09, alive at base.
		Euonymus (Spindle Tree).
1217	6	E. bungeanus '09, two vigorous, other 4 killed to base.
872	6	E. linearis '09, thrifty, though a few tips killed.
563	6	E. sieboldianus '09, killed half back.
		Fraxinus (Ash).
918	4	F. mandshurica '09, thrifty but tips killed back.
		Gleditschia (Honey Locust).
831	20	G. triacanthos '08, all dead.
447	4	G. triacanthos inermis '08, killed back somewhat ; '09, two dead but two only killed back slightly.
		Hydrangea.
468	6	H. paniculata grandiflora '08, 5 alive ; '09, killed $\frac{3}{4}$ back.
		Juglans (Walnut).
1510	6	J. nigra (black walnut) '08, 1 alive ; '09, alive at root.
		Kolreuteria.
991	2	K. paniculata '08, 1 alive '09 ; dead.
		Lespedeza.
842	2	L. Sieboldi '08, 1 alive ; '09, alive at base.

TREES AND SHRUBS (IRRIGATED)—*Continued.*

Reference Number.	No. set out.	Name.
		Ligustrum (Privet).
368	3	L. amurense '08, thrifty ; '09, killed about half back.
		Lonicera (Honeysuckle).
848	4	L. Alberti '09, thrifty, in bloom.
960	7	L. Alpina '08, 6 alive ; '09, alive at base but vigorous.
949	6	L. Fenzlei '09, killed nearly to base.
860	40	L. grandiflora '09, thrifty though some tips have killed back.
364	4	L. grata '07, 3 alive ; '08, thrifty ; '09, growing from base.
980	6	L. Morrowi '09, vigorous but about ¼ killed back.
955	5	L. Voronesh No. 133, '08, 3 alive ; '09, alive at base but thrifty.
391	3	L. from Manitoba '08, thrifty ; '09, thrifty.
1077	6	L. tatarica virginalis alba '08 alive; '09, thrifty, killed back but little, bloomed.
		Philadelphus.
525	6	P. coronarius foliis aureis, '08, 4 alive ; '09, 3 alive, killed to base.
1563	4	P. grandiflorus, '08, killed back ; '09, alive at base.
1006	6	P. hybridus Lemoinei Manteau d'Hermine, '08, 5 alive ; '09, alive at base.
1039	6	P. hybridus Lemoinei Fantasia, '08, alive ; '09, alive at base.
1500	4	P. hybrida Lemoinei Mont Blanc, '09, alive at base.
		Populus (Poplar).
1025	2	P. angustifolia, '09, vigorous.
		Prunus (Plum).
1002	4	P. alleghaniensis, '09, killed back about half.
		Ptelea (Wafer Ash).
976	4	P. trifoliata, '08, 3 alive but killed back ; '09, alive at base.
		Pyrus.
	6	P. floribunda, fall, '07, 1 dead ; '08, 3 alive.
1445	1	P. Ioensis, '09, killed half or more back.
1226	2	P. intermedia, '09, thrifty, one killed back a little.
485	5	P. Mougeoti, '07, 3 alive ; '09, killed ⅔ back.
852	6	P. Malus Sargenti, '08, 3 alive ; '09, alive at base.
		Quercus (Oak).
832	30	Q. alba (white oak), '07, 20 alive ; '08, 8 alive but killed back ; '09, very small, killed about half back.
572	4	Q. palustris, '08, 2 alive killed back ; '09, alive at base only.
401	6	Q. rubra, '08, alive but all killed back ; '09, all killed back but not quite to ground.
		Rhamnus (Buckthorn).
566	6	R. davurica, '09, not particularly thrifty.
1087	6	R. Frangula, '09, killed nearly to base.
		Rhodotypos.
531	6	R. kerrioides, '08, all alive ; '09, 5 alive, killed to base.
		Rhus (Sumach).
445	2	R. Cotinus, '07, one dead ; '08, one alive ; '09, dead.
		Robinia (Locust tree).
811	30	R. Pseudacacia (black locust), '07, did not establish themselves well, 10 alive in fall ; '08, all dead.

TREES AND SHRUBS (IRRIGATED)—*Continued.*

Reference Number.	No. set Out.	Name.
		Rosa (Rose).
1241	2	R. cinnamomea, '09, alive.
457	2	R. ferox, '08, 1 alive ; '09, alive at base.
440	2	R. humilis, '08, killed back some ; '09, partly dead.
990	1	R. lucida alba, '09, killed to base.
459	2	R. lutea, '08, 2 alive ; '09, partly killed back.
878	9	R. rugosa, '09, fairly thrifty.
399	2	R. spinosissima hispida, '08, thrifty ; '09, thrifty.
369	2	R. tomentosa, '08, thrifty ; '09, thrifty.
389	2	R. Virginiana, '08, thrifty ; '09, thrifty.
		Roses.
349	1	R. alba rubrifolia, '08, thrifty.
344	1	R. Crimson Rambler. (Philadelphia). '08, thrifty ; '09, fairly hardy.
352	1	R. Dorothy Perkins, '08, almost dead ; '09, killed back to roots.
351	1	R. Evergreen Gem, '08, thrifty ; '09, fairly thrifty.
354	1	R. Frau Karl Druschke, '08, thrifty, good blooms (white) ; '09, dead.
345	1	R. Helen Gould, '08, in bloom, very fine ; '09, thrifty.
359	1	R. Lady Gay, '08, thrifty ; '09, dead.
346	1	R. May Queen, '08, dead.
358	1	R. Marshall P. Wilder, thrifty, very choice ; '09, small but thrifty.
353	1	R. Madame Gabriel Luizet, '08, dead.
357	1	R. New Century, '08, thrifty ; '09, half-hardy.
356	1	R. Paeonia, red, half double, '08, thrifty ; '09, thrifty.
350	1	R. Pearl Queen, '08, thrifty ; '09, killed back badly.
351½	1	R. Ruby Queen, '08, thrifty.
348½	1	R. Sir Thos. Lipton, '08, thrifty, in bloom (white); '09, thrifty.
347	1	R. Universal Favourite, '08, thrifty ; '09, thrifty.
348	1	R. Wm. C. Egan, '08, thrifty ; '09, looks vigorous.
		Rubus.
496	4	R. fasciculatus chinensis, '09, killed to base.
		Salix (Willow).
804	6	S. rosmarinifolia, '08, killed back ; '09, killed to base.
934	5	S. Voronesh, '08, thrifty; '09, tips killed back.
		Sambucus (Elder).
926	4	S. nigra aurea nova, '09, killed to base.
		Spiraea (Meadow Sweet).
939	4	S. arguta, '08, 3 alive ; '09, about half killed back.
363	6	S. callosa superba, '08, thrifty, in bloom.
1083	4	S. sorbifolia, '09, alive at base.
887	6	S. Van Houttei, '09, killed back about ⅔, bloomed.
		Syringa (Lilac).
443	2	S. amurensis, '08 and '09, thrifty.
451	6	S. pekinensis, '08, 5 alive ; '09, 4 alive and all killed about ⅔ back.
...	76	S. villosa, '09, all alive and perfectly hardy.
541	2	S. vulgaris Boussingault, '09, thrifty.
462	6	S. " Charles X, '09, all thrifty but one killed at tips.
540	3	S. " Condorcet, '09, thrifty.
564	6	S. " Congo, '09, thrifty.
.	16	S. " ....?, '09, all alive and thrifty.
550	2	S. " Abel Carriere, '09, fairly thrifty,
553	1	S. " Dr. Troyanowsky, '09, partly thrifty.
545	4	S. " Emile Lemoine, '09, thrifty though killed back a little.
546	2	S. " Flora plena Linné, '09, fairly thrifty.
562	1	S. " Francisque Morel, '09, partly thrifty.
561	6	S. " Jacques Calot, '09, thrifty.
542	4	S. " La Tour d'Auvergne, '09, thrifty.

TREES AND SHRUBS (IRRIGATED)—*Continued.*

Reference Number.	No. set Out.	Name.
		Syringa (Lilac)—Concluded.
554	2	S. " Leon Simon, '08, 1 alive, '09, only partly thrifty.
551	2	S. " Louis Heury, '09, partly thrifty.
565	2	S. " Ludwig Spath, '09, thrifty.
544	2	S. " Madame Abel Chatenay, '09, thrifty.
549	2	S. " " Briot, '07, not very thrifty.
555	6	S. " " Casimir Perier, '08, 5 alive ; '09, 4 of the 5 thrifty.
547	2	S. " " Lemoine, '09, fairly thrifty.
538	7	S. " Mademoiselle Fernande Viger, '09, thrifty.
552	2	S. " Président Grévy, '08, 1 alive ; '09, partly thrifty.
548	2	S. " Prince de Beauveau, '09, fairly thrifty.
537	1	S. " Madame de Miller, '08, thrifty ; '09, partly killed back.
543	1	S. " rothamagensis metensis, '09, killed back slightly.
479	6	S. " Souvenir de Ludwig Spāth, '08, 2 alive ; '09, hardy but small grower.
539	2	S. " rubella plena, '09, thrifty.
		Tilia (Linden, Basswood).
576	2	T. Europæa, '08, badly killed back ; 09, 1 alive killed back half.
		Ulmus (Elm).
829	400	U. americana, '07, established themselves well ; '08, 95 per cent killed half way back ; '09, killed back same as last year, some clear to base. (Note). These trees were grown from seed collected in northern part of U. S., not from Manitoba.
		Viburnum (Arrowwood)
500	6	V. dentatum, '09, killed to base.
1262	6	V. molle, '09, all more or less killed back.
1255	1	V. sargenti, '09, ½ killed back.
986	2	V. venosum, '09, alive at base.
		List of Coniferae. Abies (Fir).
...	20	A. balsamea, '07, nearly all dead ; '08, dead.
416	2	A. concolor, '07, 1 alive ; '09, living.
		Juniperus (Juniper).
421	4	J. Sabina, '08, 1 alive ; '09, barely alive.
		Larix (Larch-Tamarac).
1288	25	L. leptolepis, '07, all dead but one ; '08, alive; '09, dead.
		Picea (Spruce).
415	2	P. Engelmanni, '08, 1 alive ; '09, dead.
513	2	P. excelsa pygmaea, '08, 1 alive ; '09, partly alive.
414	6	P. pungens, '08, thrifty ; '09, thrifty.
		Pinus (Pine).
419	12	P. sylvestris (Scotch pine), '07, 8 alive ; '09, six of the 8 are thrifty.
		Pseudotsuga.
782	50	P. Douglasii, '07, 8 lived ; '09, small but thrifty.
		Thuya. (Arbor Vitae).
1165	6	T. occidentalis globosa, '07, 4 dead ; '08, 2 alive ; '09, alive at base.
417	6	T. occidentalis Hoveyi, '08, alive but killed back ; '09, about dead, only 3 showing signs of life.

LAYING OUT A VEGETABLE GARDEN.

In a new country like this, where grain-raising is so universally followed, the vegetable garden is apt to be neglected. The excuse offered is that there are so many other things to do that one has not time to bother with it, but, by a little care in laying out the ground, much of the hand-work, which is the bugbear, may be avoided. The different kinds of vegetables should be planted in rows far enough apart to allow a horse cultivator to be worked between them. The amount of land used is generally of little moment to the farmer for at most it is a small area, so the rows for lettuce, onions, &c., may be put 2 feet apart. The larger-growing plants, such as peas and potatoes, &c., may be put 3½ or even 4 feet apart. On land that cannot be irrigated there is an added advantage in this, for it gives more space for the roots to forage for moisture. The rows should be made somewhat long so that there need not be too much time lost in turning. It is not necessary that a full length row of any one kind be planted. For example, if the garden is 600 feet long, any desired part of this length of row may be sown with lettuce, then on the same row as many feet of radish as required and so on down the list of vegetables that one wishes to put 2 feet apart. By planting the garden in this way, it is possible, if a horse cultivator is used occasionally, to raise a lot of vegetables with very little hoeing and other hand work. Always give level cultivation and hill or bank the plants as little as possible to avoid drying the land out.

IRRIGATING VEGETABLES.

What has just been said about planting the garden in long rows is particularly important where irrigation is to be practised. The rows should always run up and down the fall of the ground so that the water will readily run down between the rows. When it is desired to give an irrigation, make a small trench between the rows, without throwing earth against the plants if possible, and then allow only a small stream of water to trickle down. Let it run until the ground is thoroughly saturated between the trenches, but do not allow the land to be flooded where the plants stand, for this causes the soil to bake and crust close around the plants, injuring them unnecessarily and quite often requiring an extra hoeing. Thorough irrigations are recommended rather than more frequent light ones. As soon as the land dries off sufficiently after each irrigation, a light cultivation should be given.

THE VEGETABLE GARDEN.

Complete notes on the various things grown in the garden will not be attempted, but some of the results that it is deemed may be of interest are given.

ASPARAGUS AND RHUBARB.

Every garden should contain an asparagus bed and some rhubarb, for it is the first early green stuff in the spring that is perhaps the most appreciated. An asparagus bed was set out in the spring of 1908 and a little was obtained for the table this year, although it usually requires from two to three years before a bed comes into full productiveness. The first cutting was made June 4.

The first rhubarb used from the roots set out in 1908 was from the Excelsior on May 28. On the non-irrigated patch, the first used was on June 4 from the Magnum Bonum and the Brabant's Colossal.

BEANS.

Of the five kinds of beans grown, the Wardwell's Kidney Wax was the best of the wax varieties. The Dwarf Extra Early Edible Pod was quite early. The Haricot

Flageolet, Short Season Green Pod Bush, and the Dwarf Wax Early gave fair results. All the varieties ripened most of their seed.

BEETS.

Crosby's Egyptian and Long Dark Smooth Blood Red were grown. The former was a little more desirable for early use.

CABBAGE AND CAULIFLOWER.

Four varieties of cabbage were grown, Early Jersey Wakefield, Prize Hard Head, World Beater and Premium Flat Dutch. The Jersey Wakefield was the earliest and gave very satisfactory results. The World Beater and the Flat Dutch do well for a main crop.

Three varieties of cauliflower were grown, Lenormand's, World's Best and Danish Drouth-Resisting. They were all early.

CARROTS.

The early Gem and the Half-Long Scarlet Luc were grown the latter is an excellent variety for summer use.

CELERY.

Three varieties were grown, New Rose, Paris Golden Yellow and Short Season Self-Blanching. The New Rose appeared to give the most satisfactory results as it yielded somewhat better and was good for winter use.

TABLE CORN.

Six varieties were grown, the Early Market, Early Premo, Squaw, Sugar. Seymour Orange Sweet and Golden Bantam. The Squaw was much the earliest, but the Golden Bantam was better in quality and flavour than any of the others. The Early Market, Sugar and Seymour Orange Sweet were too late; as they were frosted just about the time the first ears were ready for use.

PEAS.

Practically all of the standard varieties of peas did well. Four varieties were planted April 22, Alaska, Rennie's Best Extra Early, Dwarf Telephone and Tall Telephone. The Alaska was the earliest, the first being used on July 8. The Dwarf Telephone was the best in quality and flavour and it had a fairly long season.

OTHER VEGETABLES.

Lettuce, radish, parsley, spinach, parsnips, &c., all did well. Of the three varieties of onions grown, Extra Early Red, Australian Brown and Golden Yellow, the last one outyielded the others. In planting onions, it is important to use only the earliest sorts. For early green onions, sets should be used. Two varieties of cucumbers were planted in the garden May 28, the Cool and Crisp and Perfection; both varieties did well. The first used from each variety was on August 7 and 12 respectively. Hubbard Squash grown from home-selected seed ripened last year, did fairly well; about half of the crop ripened. Early Yellow Bush Scallop Squash did not do quite as well as usual as only about half of the crop matured. Pumpkins were somewhat late, only a few ripening. A few muskmelons ripened after the frost killed the vines. The variety used was Earliest of All. Only one variety of tomatoes was grown, Sparks' Earliana from selected seed supplied from the Central Experimental Farm. Owing to a mishap to the plants while in the cold frame, they were small and weak

when put out in the garden, which was not done till July 2. However, quite a few tomatoes set on the vines and a number ripened.

FLOWERS.

In the flower garden, the annuals will always have a place, but perennials should be given particular attention for they come on year after year, producing strong, vigorous blooms earlier than the average annuals do. There are a number of hardy perennials that might be mentioned, but probably there is none more satisfactory than the pæony, for, after it is once established, it is extremely hardy, withstanding, if necessary, much neglect and still making a beautiful display of blooms.

ANNUALS.

The following annuals were planted in the open during the latter part of May and most of them made a nice showing during the summer and fall: Pansy, Dianthus, Asters, Abronia Umbellata, Antirrhinum Majus, Poppy, Godetia, Candytuft, Coreopsis, Nicotiana, Ageratum, Brachycome, Lobelia, Mignonette, Petunia, Phlox Drummondi, Bartonia, Gaillardia, Scabiosa, Balsam.

BULBS.

The following bulbs were set out in the fall of 1908:—

Crocuses.—Blue, Yellow, Purple, Striped variegated, White.

Tulips.—Artus (brilliant scarlet), Cottage Maid (rose pink and white), Chrysolora (pure yellow), Double superfine (mixed colours), Duc van Tholl (crimson), Duc van Tholl (gold laced), Gesneriana spathulata (scarlet and blue), Gloria solis (red, with gold), Joost von Vondel (cherry-red, white feathered), Kaiser's Kroon (scarlet and yellow), L'Immaculate (white), Parrot (mixed), Pottebakker (yellow), Pottebakker (white), Pottebakker (scarlet), Prosperine (carmine rose).

Other bulbs.—Bulbocodium vernum, Chionodoxa gigantea (Glory of the Snow), Colchicum autumnale (Meadow Saffron), Frittillaria Imperialis, Galanthus nivalis (Snowdrops), Giant Snow Drops, Iris Hispanica, Leucojum aestivum, Frittillaria vernum (Snowflake), Scilla Sibirica (Squills).

The exceptional winter conditions were apparently unfavourable for bulbs. The crocuses and tulips all lived through, but the blooms were not so large as they were last year. Most of the other bulbs failed to grow in the spring.

MEASUREMENT OF WATER USED IN IRRIGATING.

On account of the railroad passing through the Farm, it is necessary to take the water from the Irrigation Company's main ditch at two points, consequently two measuring devices are required. Two 2-foot Cippoletti weirs have been installed. A Lalli water register is used at one and a Freiz water register at the other. A complete record of the water used north of the track was obtained from the Freiz register, but the record at the weir on the south side of the track was not satisfactory. North of the track there was 21·9 acres under crop this season. It was all sown in grain. One flood irrigation was given, which began at noon on July 10 and was completed on the forenoon of the 17th. This was the first irrigation the land had ever received. The prairie had been broken the previous June and spring wheat, oats, barley, and a small area of peas were sown this spring. The surface was irregular on account of some old laterals that had been ploughed in. During one or two nights, considerable waste water ran off the field and there was no means at hand to determine this amount, but possibly it was not more than is often wasted by the average irrigator in the district.

To the 21·9 acres, in the one irrigation 40·1137 acre feet of water were applied. For the benefit of any who are not familiar with the term, it might be explained that an 'acre-foot' is a unit of measure in common use in irrigation districts and expresses the quantity of water necessary to cover an acre a foot deep. Considering the character of the soil, which is a clay to a sandy loam underlaid with a clay subsoil, this is a large amount of water for a single irrigation for it was sufficient to cover the whole area a little over 1·83 feet deep. The average volume of the stream used was approximately 3 second feet, which means that there were 3 cubic feet of water passing a given point on the ditch every second, or in other words that there were 3 cubic feet of water per second flowing on to the field during the time that the irrigation was in progress.

The record of the water used on the south side of the track is not quite complete this season. Quite small fields were irrigated, so these data will not be given here but will be kept on file and may be used in the future.

HORSES.

Eight work horses and two drivers are kept on the Farm. In addition to these, there are one three-year-old colt and a two-year-old filly.

CATTLE.

Two grade cows are kept to supply milk to the families on the Farm. A two-year-old heifer, the calf of one of these cows, has been raised, but will be disposed of, as it has not developed into a very desirable animal.

FARMERS' EXCURSION TO THE FARM.

The Provincial Department of Agriculture arranged for an excursion to the Farm on July 23. A special Canadian Pacific railway train was run from Calgary, and special rates were obtained over the A.R. & I Co.'s lines. This was the first excursion of this kind to the Farm and there were quite a large number of farmers who availed themselves of the opportunity.

MEETINGS AND CONVENTIONS ATTENDED.

Being secretary of the Western Irrigation Association for the current year, I had considerable work in connection with the third annual meeting which was held at Spokane, August 9 to 13, at which I spent a most profitable week. I attended the Dry-Farming Congress at Billings, Montana, October 25 to 29, and delivered an address.

During the year I have attended a number of seed fairs, acting as judge and speaking on various subjects at the conclusion of the judging. I also acted as one of the judges at the Provincial Seed Fair.

DISTRIBUTION OF SAMPLES.

A distribution of samples of grain, potatoes and small packets of seedling trees was made from the Farm and the following material was sent out up to March 31, 1910:—

5-lb. bags of winter wheat	167
5-lb. bags of spring wheat	299
5-lb. bags of barley	95
4-lb. bags of oats	170
3-lb. bags of potatoes	568
Total number of samples distributed	1,299

SALE OF GRAIN.

In disposing of the surplus wheat, a rule has been made limiting each applicant to not more than four bushels. This, if sown on well-prepared summer fallow or June breaking, will produce from 100 to 200 bushels of seed for the second season. Up to March 31, 228 of these 4-bushel lots of wheat have been sold.

CORRESPONDENCE.

For the twelve months ending March 31, 1910, there were 3,748 letters received and 3,517 letters sent out, not including circulars and reports.

METEOROLOGICAL REPORT.

Months.	Highest Temperature.		Lowest Temperature.		Total Precipitation.	Bright Sunshine.
1909.	Date.	Degrees.	Date.	Degrees.	Inches.	Hours
April	24	68·2	30	3·0	1·148	231·4
May	3	76·9	6	24·8	4·01	231·6
June	15	84·6	25	34·5	0·82	302·4
July	23	90·8	7	39·8	1·54	345·7
August	14	91·0	29	29·6	0·08	378·7
September	25	87·9	14	26·8	0·47	241·4
October	3	75·5	30	10·4	0·37	185·6
November	3	61·4	15	−17 4	0·46	88·5
December	29	49·4	7	−28·4	0·42	101·8
1910.						
January	23	55·1	2	−12·4	0·24	170·0
February	5	43·0	22	−35·5	0·83	116·0
March	20	74·0	1	3·4	0 17	151·8
Totals					10·558	2544·9

In the above, 10 inches of snow is computed as 1 inch of precipitation.

The hours of bright sunshine for the months of February and March, 1910, are not correct, being less than actually occurred, owing to the fact that the instrument from about February 20 to March 14 was out of order and did not make a complete record of all the hours the sun was shining.

ACKNOWLEDGMENT.

It is certainly a pleasure to take this opportunity of acknowledging the faithful services of each member of the Farm staff and of expressing my appreciation of the intelligent interest they have taken in the past year's work. I am especially grateful to W. C. Poland, the Foreman, for the careful notes he has kept and for his aid and general co-operation.

I have the honour to be,

Your obedient servant,

W. H. FAIRFIELD,

Superintendent.

EXPERIMENTAL FARM FOR CENTRAL ALBERTA

REPORT OF G. H. HUTTON, B.S.A., SUPERINTENDENT.

LACOMBE, ALTA., March 31, 1910.

Dr. WM. SAUNDERS, C.M.G.,
Director Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit to you my third annual report covering the operations of the Experimental Farm for Central Alberta, at Lacombe, for the year ending March 31, 1910.

The spring of 1909 was later than that of 1908, and, after the snow melted, there was considerable thawing and freezing. These warm days and cool nights proved very trying on winter wheat, which, in all parts of the province, was rather badly spring-killed.

The first seed was sown on this Farm on April 19 but, because of the hard night frosts, seeding did not progress as rapidly as usual and field crops of wheat were not sown till May 1, which was, this year, too late to give time to mature.

Weather conditions were very favourable after night-freezing ceased and all grain crops grew rapidly, making up, to some extent, for the rather late seeding. Moisture was not lacking, while the season developed warmer nights than usual and all test plots and field crops gave promise of a bountiful harvest.

The first hail storm on record for this locality passed through the district on August 1, covering a stretch of country about 2½ miles wide by 20 miles in length. Since many of the earlier varieties of grain were nearing maturity on that date, it is impossible to draw positive conclusions from the results of the experiments with cereals reported herewith. The figures show clearly that the later varieties and those varieties having stiff straw suffered less from this storm than did the earlier varieties and those having finer or weaker straw.

The yields secured are far from a crop failure and are an indication of the splendid harvest enjoyed by the country generally.

EXPERIMENTS WITH WINTER WHEAT.

The spring of 1909 was very trying on winter wheat. From results on this Farm and elsewhere, it is evident that wheat came through much better on breaking or on sod than on summer-fallow. It is certain that the soil is firmer on breaking and on sod than on summer-fallow, and consequently the rise of moisture on the former is more rapid. The results given herewith indicate the effect of the continual thawing and freezing of the early spring. They also indicate the relative hardiness of Dawson's Golden Chaff and Turkey Red. These results were secured on land from which a hay crop was taken in 1908; the land was then ploughed, disced, packed, and prepared for winter wheat. The short period of cultivation given after ploughing was insufficient to subdue the timothy completely and much of it came on in the spring

with the winter wheat that survived. The stand of wheat being thin made conditions more favourable for the production of timothy seed. The average yield of timothy seed, which was separated by the machine at threshing, is also given.

The test plots of different varieties, all of which were sown on summer-fallow, were completely spring-killed and therefore no figures are available for these tests.

WINTER WHEAT—Quantities of Seed per Acre.

Variety.	Quantity of Seed.	Date Sown.	Date Cut.	Yield per Acre.		Average Yield of timothy seed per Acre.	
		1908.	1909.	Bush.	Lbs.	Bush.	Lbs.
Turkey Red	½ bushel	Aug. 15	Aug. 20	8	3¾	5	38½
"	¾ "	" 15	" 20	11	22½		
"	1 "	" 17	" 20	10	00		
"	1¼ "	" 17	" 20	5	52½		
"	1½ "	" 17	" 20	11	26¼		
"	1¾ "	" 17	" 20	10	37½		
"	2 "	" 17	" 20	12	33¾		

In the above test, Dawson's Golden Chaff was sown side by side with Turkey Red at the same rates of seed per acre but was so nearly killed out that it was ploughed under.

WINTER WHEAT—Dates of Sowing.

On the first day of August, a sowing was made of Dawson's Golden Chaff and Turkey Red, at the rate of 75 pounds of seed per acre, on fall-ploughed timothy sod. Sowings of each variety at weekly intervals were made up to September 12, but none of the plots sown on or after August 15 were considered worth leaving. While early-sown wheat suffered badly by spring killing, seedings made up to about the middle of August proved hardier this year than seedings made after that date.

WINTER WHEAT—Dates of Sowing.

Variety.	Date of Sowing.	Date Cut.	Yield per Acre.		Average Yield of timothy seed per Acre.	
	1908.	1909.	Bush.	Lbs.	Bush.	Lbs.
Turkey Red	Aug. 1	Aug. 20	4	45	9	1
"	" 8	" 20	9	11¼		
Dawson's Golden Chaff	" 1	" 20	1	11¼	9	4½
" "	" 8	" 20	5	26½		

EXPERIMENTS WITH SPRING WHEAT.

Twelve varieties of spring wheat were sown on April 19 on timothy sod ploughed in 1908 after the hay crop was harvested. All varieties made splendid growth with no indication of rust, but their relative standing has been influenced, without doubt, by the hail storm of August 1. This storm also affected the length of time required to ripen, as development was checked and afterward most varieties came on together. Seed was used at the rate of about one and three-quarter bushels per acre. All plots were one-sixtieth of an acre each and the soil was black clay loam.

SPRING WHEAT—Test of Varieties.

Number.	Variety.	Date of Ripening.	No. Days Maturing.	Length of Straw including Head.	Character of Straw.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per Measured Bushel after Cleaning.
				Inches.		In.		Lbs.	Bush.	Lbs.	Lbs.
1	Hungarian White....	Sept. 6.	140	54	Stiff.	3¾	Bearded....	6,480	42	52½	62½
2	Pishop..............	" 11.	145	52	"	3½	Beardless...	7,065	42	13	60
3	Chelsea	" 4.	138	51	"	4¼	"	5,565	33	13	58
4	Pringle's Champlain....	" 6.	140	53	"	3½	Bearded.. ..	6,105	32	18¾	62
5	Marquis	" 4.	138	49	"	3¾	Beardless...	5,505	30	13	60½
6	Huron....	Aug. 28.	131	48	"	3¼	Bearded....	4,980	28	00	60
7	Percy	Sept. 4.	138	51	"	3½	Beardless ..	4,485	23	22¼	57½
8	White Fife	" 11.	145	50	"	3½	"	4,740	21	3¾	57
9	Preston..............	Aug. 28.	131	51	u	3½	Bearded....	4,980	20	00	57½
10	Stanley..............	" 28	131	52	"	4¼	Beardless..	5,115	17	39¼	57
11	Red Fife H...........	Sept. 6.	140	50	"	3	"	5,295	14	52½	52
12	Riga.................	Aug. 21.	123	41	"	2½	"	4,235	12	33¾	59

SPRING WHEAT—Dates of Sowing.

Four sowings of Chelsea Beardless spring wheat were made at intervals of one week. All seedings were made on similar soil and seed at the rate of 1¾ bushels per acre was used in each case. No rust was observed.

Variety.	Date Sown.	Date of Ripening.	Length of Straw including Head.	Character of Straw.	Length of Head.	Weight of Straw.	Yield per Acre.	
			Inches.		Inches.	Lbs.	Bush.	Lbs.
Chelsea............	April 19..	Sept. 4....	51	Stiff......	4¼	5,565	33	13
"	" 26..	" 11. ..	53	"	4	6,105	31	15
"	May 3..	" 11....	52	"	4	5,775	31	41¼
"	" 10..	" 11....	53	"	4¼	6,900	39	00

SPRING WHEAT—Quantities of Seed per acre.

Five sowings of Chelsea were made on April 26 at different rates of seed per acre with the following result. All were harvested September 11. No rust was observed.

Variety.	Bushels Seed per Acre.	No. days Maturing.	Length of Straw Including Head.	Character of Straw.	Length of Head.	Weight of Straw.	Yield per Acre.	
			Inches.		Inches.	Lbs.	Bush.	Lbs.
Chelsea............	¾	142	57	Stiff.....	4¼	6,375	28	39¼
"	1¼	140	55	"	4	6,225	29	11¼
"	1¾	138	55	"	3¾	5,970	29	26¼
"	2¼	138	54	"	3¼	6,675	36	50½
"	2¾	136	52	"	3¼	6,255	33	46¾

EXPERIMENTS WITH EMMER AND SPELT.

Plots of one-sixtieth of an acre each of Common Emmer and Red Spelt were sown on May 6. The soil and its cultivation was similar to that for the other test plots. The seed was sown at the rate of 120 pounds per acre.

Variety.	Date Ripened.	No. of days Maturing.	Length of Straw.	Character of Straw.	Length of Head.	Kind of Head.	Yield per Acre.	Weight of Straw.
			Inches.		Inch.		Lbs.	Lbs.
Common Emmer........	Sept. 11	128	46	Stiff.	2½	Bearded.	1,140	4,380
Red Spelt	" 11	128	50	"	4	Beardless.	1,560	5,100

EXPERIMENTS WITH RYE.

One plot of bearded fall rye was sown on August 27, 1908, and a plot of bearded spring rye on May 6, 1909. The soil was a black clay loam and was cultivated in a similar manner as for the fall and spring wheats. Seed was used at the rate of one and one-half bushels per acre.

Variety.	Date Ripened.	Days Maturing.	Length of Straw.	Character of Straw.	Length of Head.	Weight of Straw.	Yield per Acre.	Weight per Bushel.
			Inches.		Inch.	Lbs.	Bush. Lbs.	
Fall Rye.	Aug. 18	356	56	Stiff.	5	4,714	24 46	58
Spring Rye.....	Sept. 1	118	58	"	4	4,290	13 30	51½

SPRING WHEAT—TEST OF COMMERCIAL FERTILIZERS.

Nitrate of Soda, Muriate of Potash, Superphosphate of Lime and Basic Slag were applied to one-sixtieth-acre plots of spring wheat (the Chelsea variety being used) in the quantities and proportions indicated below. The storm of August 1 was most severe along the north boundary of the Farm and the yield of these plots, which were located nearer the northern line than any other so far reported on, is correspondingly low.

Variety.	Lbs. per Acre.	Fertilizer.	Date of Ripening.	No. of days Maturing.	Weight of Straw.	Yield per Acre. Bush.	Yield per Acre. Lbs.
					Lbs.	Bush.	Lbs.
Chelsea	500	Basic Slag..........	Aug. 21	110	3,596	13	3¾
"	200	Nitrate of Soda..........	" 21	110	4,247	15	13
"	300 100	Superphosphate of Lime. Muriate of Potash.......	" 21	110	3,247	8	52½
"	500 100	Basic Slag.......... Muriate of Potash...	" 21	110	2,741	8	18¾
"	300	Superphosphate of Lime....... .	" 21	110	3,656	12	3¾
"	100	Muriate of Potash....	" 21	110	2,831	12	48¾
"	300 100 200	Superphosphate of Lime. Muriate of Potash.. ... Nitrate of Soda.........	" 21	110	3,435	7	45
"		Check Plot.....	" 21	110	2,295	5	45

SPRING WHEAT SOWN IN FALL.

A plot of one-sixtieth of an acre of Stanley spring wheat was sown on November 4, 1908. This grain germinated in the spring and made good growth. It was cut on August 28 and yielded 12 bushels and 30 pounds per acre.

EXPERIMENTS WITH OATS.

All experiments with oats were conducted on land ploughed out of timothy sod in 1908 after the hay crop was harvested. The land was packed the same day and disced up at once. There was no lack of moisture in the spring of 1909. The seed was sown on May 5 at the rate of about one and one-half bushels per acre, with the exception of one plot of Garton's 'Regenerated' Abundance, which was sown at the rate of 5½ bushels per acre. Thirty varieties were tested on plots of one-sixtieth of an acre each. The soil was a black clay loam.

OATS—Test of Varieties.

Number.	Variety.	Date of Ripening.	No. of Days Maturing.	Length of Straw including Head.	Character of Straw.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Inches.		In		Lbs.	Bush.	Lbs.	Lbs.
1	Golden Beauty	Aug. 24	111	51	Stiff.. ..	8½	Branching	6,375	59	19	36
2	Garton's 'Regenerated' Banner...	" 24	111	52	"	9	"	6,720	58	8	39½
3	Danish Island....	" 25	112	50	"	9¼	"	6,990	57	12	37½
4	Pioneer....	" 21	108	47	"	8½	"	5,760	56	16	43
5	Improved American.......	" 27	114	51	"	10½	"	6,480	56	16	37½
6	Siberian..................	" 26	113	54	"	8	"	6,360	54	14	36½
7	Milford White............	" 25	112	54	"	9	Sided	6,000	51	6	37½
8	Irish Victor	" 27	114	50	"	8	Branching	6,360	51	6	39½
9	Garton's Victor...........	" 21	108	49	"	11¾	"	5,340	49	14	38½
10	Kendal White	" 27	114	52	"	10	"	5,700	47	22	37
11	Garton's 'Regenerated' Abundance.............	" 24	111	57	"	9	"	6,720	47	22	37
12	Wide Awake.............	" 24	111	50	" ...	9	"	6,300	47	22	36
13	Tartar King.......... ...	" 26	113	53	"	9¼	Sided	5,415	47	7	30
14	Abundance	" 28	115	56	"	9½	Branching	6,450	46	26	36½
15	Storm King.......	" 24	111	59	"	11	Sided . ..	6,345	46	11	30
16	American Triumph....	" 24	111	53	"	9¼	Branching	6,360	45	30	38½
17	Banner......	" 24	111	51	"	8¾	"	6,525	44	19	37½
18	Montgomery.......... ...	" 26	113	50	"	10¼	"	5,505	42	27	35½
19	Swedish Select............	" 26	113	50	"	7¼	"	5,340	42	12	33
20	Poland....................	" 21	108	56	"	11	"	5,280	42	12	37½
21	White Giant...............	" 24	111	45	"	10	"	5,235	41	31	38
22	Twentieth Century...... ..	" 26	113	49	" . . .	8½	"	5,085	41	1	37
23	Thousand Dollar..	" 24	111	48	"	8	"	6,060	40	20	34
24	Garton's 'Regenerated' Abundance (5½ bush. seed)	" 21	108	43	"	7	"	5,400	40	20	37
25	Dawson	" 21	108	55	"	10	"	5,550	39	24	42
26	Improved Ligowo.........	" 26	113	50	"	7½	"	6,060	38	28	36
27	Alsasman...	" 24	111	52	"	8¾	"	5,820	37	2	34
28	Lincoln.....	" 24	111	54	"	8½	"	5,790	35	40	35
29	Virginia White	" 24	111	46	"	8	"	5,130	34	14	35
30	Orloff	" 18	105	40	Medium	7	"	3,840	28	8	31

OATS—FALL SOWN.

On November 9, 1908, a plot of Tartar King oats was sown on well-prepared summer-ploughed timothy sod. As winter weather set in the night of the 9th of November, the seed did not germinate in the fall. In the spring, the oats came on early, grew well and were fairly well matured when partially threshed by the hail storm on August 1. Further work will be necessary in this direction before conclusions can be drawn. At present the fall sowing of oats is not advised.

FALL SOWN OATS.

Date Sown.	Date Cut.	Length of Straw.	Character of Straw.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.
		Inches.		Inches.		Lbs.	Bush. Lbs.
Nov. 4, '08 ..	Aug. 21....	52	Stiff	9½	Sided.	5,760	17 22

OATS—QUANTITIES OF SEED PER ACRE.

At the rate of one bushel per acre and increasing at the rate of one-half bushel per acre in each plot up to four and one-half bushels per acre, Banner and Thousand Dollar oats were sown side by side on the same day. The figures this year would indicate that from 2 to 2½ bushels of seed per acre may be expected to give the best results. In previous tests, from 3 to 3½ bushels per acre have given the largest yields. The quantity of seed per acre has an influence on early maturity. Grains nearing maturity on the 1st of August suffered more from the hail than greener plots.

OATS—Quantities of Seed per Acre.

Variety.	Bush. seed per Acre.	No. of days maturing.	Character of Straw.	Length of Head.	Weight of Straw.	Yield per Acre.
				Inches.	Lbs.	Bush. Lbs.
Banner...............	1	114	Stiff	9¾	4,620	33 18
"	1½	114	"	10	5,775	43 23
"	2	113	" . . .	9	5,280	56 16
"	2½	112	"	9	5,700	50 25
"	3	110	"	9	6,045	51 21
"	3½	107	"	8¾	6,270	46 26
"	4	107	"	8½	5,400	45 30
"	4½	107	" ...	7½	5,520	42 12
Thousand Dollar...............	1	114	"	10	5,790	36 6
" "	1½	111	"	9	5,415	38 13
" "	2	110	"	8½	5,340	38 28
" "	2½	110	"	8	5,205	39 9
" "	3	107	"	7½	5,415	33 3
" "	3½	107	"	7½	5,685	30 15
" "	4	107	"	7	4,500	26 16
" "	4½	107	"	7	4,530	23 28

OATS—DATES OF SOWING.

Two varieties of oats were sown under similar conditions on different dates, commencing May 3 and continuing at intervals of one week to May 31.

OATS—Date of Sowing.

Variety.	Date Sown.	Date Ripened.	No. of days Maturing.	Weight of Straw.	Yield per Acre.
				Lbs.	Bush. Lbs.
Banner	May 3	Aug. 24	113	6,435	43 23
"	" 10	" 27	109	5,700	44 4
"	" 17	Sept. 1	107	6,075	54 9
"	" 24	" 1	100	5,970	64 14
"	" 31	" 11	103	7,110	90 30
Thousand Dollar	" 3	Aug. 24	113	6,060	40 20
" "	" 10	" 27	109	4,950	36 6
" "	" 17	Sept. 3	109	5,985	44 19
" "	" 24	" 6	105	6,090	50 10
" "	" 31	" 11	105	6,420	74 4

APPLICATION OF BARNYARD MANURE TO OATS.

In 1908, applications of barnyard manure at 10 and 20 tons per acre were made to land on which oats were to be sown. Oats were again sown on this land in 1909, on May 4, and in addition fresh plots were manured this year. Following is the table:—

OATS—Manure.

Variety.	Manure.	Quantity of Seed.	Date Ripened.	No. of days Maturing.	Yield.
	1908.	Bush.			Bush. Lbs.
Banner	None	2½	Aug. 21	109	45 15
"	10 tons	2½	" 21	109	39 24
"	20 "	2½	" 21	109	45 0
	1909.				
"	10 tons	2½	" 21	109	49 14
"	20 "	2½	" 21	109	67 2

EXPERIMENTS WITH BARLEY.

The barley crop of 1909 gave splendid promise. All test plots were sown on fall-ploughed timothy sod, well worked both in the fall and spring. Under usual conditions, a heavy yield would have been secured. Seed was sown at the rate of about two bushels per acre of the ten six-rowed, and two and one-quarter bushels per acre of the eleven two-rowed varieties tested. The soil was a black clay loam; all plots were one-sixtieth of an acre in size and were sown on May 4.

SIX-ROWED BARLEY—Test of Varieties.

Number.	Variety.	Date Ripened.	Days Maturing.	Length of Straw.	Character of Straw.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Inches.		Inches.		Lbs.	Bush.	Lbs.	Lbs.
1	Mensury........	Aug. 18	106	50	Stiff....	3¼	Bearded..	5,700	40	—	45
2	Claude..........	" 14	102	47	" ...	2¼	" ..	5,130	33	6	37½
3	Mansfield........	" 14	102	50	" ...	2¾	" ..	5,220	28	36	44
4	Odessa...	" 14	102	46	" ...	2½	" ..	5,340	27	24	45
5	Oderbruch.... ...	" 14	102	48	" ...	3	" ..	4,860	20	—	41½
6	Albert	" 14	102	50	" ...	3¼	" ..	5,610	19	18	40
7	Yale	" 14	102	52	"	2¼	" ..	4,950	19	18	42
8	Nugent...... ...	" 14	102	48	" ...	3¼	" ..	3,690	18	6	41
9	Stella..........	" 14	102	46	" ...	3	" ..	4,590	18	6	43
10	Trooper.........	" 14	102	48	" ...	2¾	" ..	3,690	16	42	41½

TWO-ROWED BARLEY—Test of Varieties.

Number.	Variety.	Date Ripened.	Days Maturing.	Length of Straw.	Character of Straw.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Inch.		Inch.		Lbs.	Bush.	Lbs.	Bush.
1	Invincible............	Aug. 18.	106	50	Stiff....	3	Bearded..	6,060	43	36	49½
2	Standwell........	" 18.	106	49	Medium	3	" .	5,220	32	24	48
3	Canadian Thorpe	" 18.	106	48	Stiff....	3	" .	4,500	28	36	46½
4	Swedish Chevalier.... .	" 18.	106	44	"	4	" .	5,250	28	6	51½
5	French Chevalier	" 18.	106	52	"	3¾	" .	5,595	23	21	49
6	Gordon	" 18.	106	57	"	2¾	" .	5,400	21	12	45
7	Beaver.......	" 18	106	60	"	5	" .	5,655	19	33	43
8	Siduey	" 18.	106	45	"	3¼	" .	3,840	18	36	46
9	Clifford..	" 18.	106	60	"	4	" .	5,160	18	36	50
10	Danish Chevalier......	" 18.	106	53	"	4¾	" .	4,995	18	21	48
11	Jarvis	" 18.	106	58	,	4	" .	5,595	15	45	47
12	*Hulless Barley	Sept. 28.	120	40	Weak..	2½	Beardless.	4,815	52	17	54

* One plot of Hulless barley was sown on May 31, at the rate of two bushels per acre. The soil and cultivation was the same as that for the other barley tests.

EFFECTS OF A DIRECT APPLICATION OF MANURE TO BARLEY.

The following table gives the results of the test started in 1908, when 10 and 20 tons per acre of barnyard manure was applied to land to be sown to barley. In 1908, the direct application of manure to barley was not beneficial, but this year the results are in its favour. Increased yields are shown as a result of the application of 1908 as well as that of 1909.

MANURE AS APPLIED TO MENSURY BARLEY.

Variety.	Manure.	Quantity of Seed.	Date Sown.	Date Ripened.	Number of days Maturing.	Yield per Acre.	
						Bush.	Lbs.
Mensury	None 1908 .. .	2 bush. ...	May 4.. ...	Aug. 14	102	13	36
"	10 Tons. 1908 .	2 "	" 4......	" 14	102	14	33
"	20 " " . .	2 "	" 4	" 14	102	23	6
"	10 " 1909...	2 "	" 4 ...	" 14	102	28	6
"	20 " " ...	2 "	" 4......	" 14. ..	102	30	30

BARLEY—QUANTITIES OF SEED PER ACRE.

With Mensury barley representing the six-rowed varieties and Invincible the two-rowed varieties, an experiment was conducted with different quantities of seed per acre. Beginning with one bushel per acre and increasing at the rate of one-half bushel per acre for each plot; tests were made up to three bushels of seed per acre.

BARLEY—Quantities of Seed per Acre.

Variety.	Quantity of Seed.	Date Ripened.	Number of days Maturing.	Length of Straw.	Character of Straw.	Length of Head.	Weight of Straw.	Yield per Acre.	
				Inches.		Inches.	Lbs.	Bush.	lbs.
Mensury............	1 Bush....	Aug. 18 ...	106	55	Stiff....	3½	4770	29	18
"	1½ " ...	" 18....	106	53	" ..	3	4665	25	35
"	2 "	" 18....	106	52	" ...	2¾	4830	28	6
"	2½ "	" 18...	106	48	" ...	2¾	4080	21	12
"	3 "	" 18....	106	47	" ...	2½	4260	18	36
Invincible.........	1 "	" 18....	106	53	" . .	3½	5910	28	6
"	1½ "	" 18....	106	52	" ...	3¼	5340	30	..
"	2 "	" 18. ..	106	50	" ...	3	5760	22	..
"	2½ "	" 18....	106	44	" ...	2¾	4455	29	33
"	3 "	" 18....	106	45	" . .	2½	5130	40	30

BARLEY—SOWN AT DIFFERENT DATES.

Mensury and Invincible barleys were sown at intervals of one week under similar conditions of soil and cultivation. The amount of seed used was about 2 bushels per acre.

BARLEY—Sown at Different Dates.

Variety.	Date Sown.	Date Ripened	Number of days Maturing.	Length of Straw.	Character of Straw.	Length of Head.	Weight of Straw.	Yield per Acre.	
				Inches.		Inches.	Lbs.	Bush.	Lbs.
Mensury.........	May 3.	Aug. 18	107	50	Stiff....	3¼	5,700	40	..
"	" 10.	" 18	100	52	Medium	3½	5,865	25	35
"	" 17.	" 18	93	52	Stiff....	3¼	6,090	29	18
"	" 24	Sept. 1	100	50	" ...	3¼	6,420	30	..
"	" 31.	" 1	93	49	" ...	3	6,195	37	9
Invincible........	" 3.	Aug. 18	107	Hailstorm prevented measurements.	" ...	Hailstorm prevented measurements.	6,060	43	36
"	" 10.	" 18	100		" ...		4,935	34	33
"	" 17.	" 18	93		" ...		5,505	29	3
"	" 24	Sept. 1	100		" ...		5,715	39	33
"	" 31.	" 5	97		" ...		6,375	34	33

TESTING THE SOIL-PACKER ON BARLEY.

In previous years, experiments with the surface soil-packer have been conducted with oats. This season, the work was done with barley. Unfortunately, these plots were on that portion of the Farm struck hardest by hail, hence the yields are low, but the result is still in favour of the use of the packer, which is strongly advised after ploughing either new or old land and again after the seed is sown. In this case, this system was followed. A determination of soil-moisture was made by Prof. Shutt which showed 38 per cent more moisture in the land which had been packed after ploughing in the fall than was contained in the land not so packed.

TESTING THE SOIL PACKER ON BARLEY.

Variety.	Soil.	Date of Ripening.	Days Maturing.	Weight of Straw.	Yield.	
				Lbs.	Bush.	Lbs.
Mensury....	Spring ploughing unpacked..	Aug. 14.....	88	2,730	14	18
"	Spring ploughing packed....	" 14.....	88	2,070	15	
"	Fall ploughing unpacked....	" 14.....	88	3,255	19	3
"	Fall ploughing packed.......	" 14.....	88	4,357	22	6

EXPERIMENTS WITH FIELD PEAS.

Sixteen varieties of field peas were sown on May 15. The soil was a black clay loam and was cultivated in a similar manner as for the other test plots. The plots were one-sixtieth of an acre each in size and the seed was sown at the rate of from two to three bushels per acre according to the size of the pea. With the exception of a second plot of the Wisconsin Blue, all plots were inoculated by means of soil from a field on which peas had made successful growth. Though all the yields are very poor, the results show an increase from inoculation.

FIELD PEAS—Test of Varieties.

Number.	Variety.	Date Ripened.	No. of Days Maturing.	Length of Straw.	Yield per Acre.	
				Inches.	Bush.	Lbs.
1	Chancellor............................	Sept. 4....	112	56	7	26¼
2	English Grey..........................	" 4....	112	58	6	20½
3	Early Britain	" 4....	112	57	6	5
4	Arthur	" 4....	112	60	5	26½
5	Daniel O'Rourke......................	" 4....	112	51	4	33¾
6	Black-Eye Marrowfat..................	" 17....	125	65	4	20½
7	Mackay................................	" 17....	125	73	4	2¾
8	Prince................................	" 17....	125	57	3	45
9	Golden Vine..........................	" 4 ...	112	57	3	37½
10	Picton................................	" 17 ...	125	60	3	24¼
11	Victoria..............................	" 17....	125	56	2	26¼
12	White Marrowfat......................	" 17....	125	58	2	20½
13	Wisconsin Blue........................	" 17....	125	54	2	13
14	Prussian Blue.........................	" 17....	125	57	2	7½
15	Gregory...............................	" 17 ...	125	70	1	22½
16	Paragon...............................	" 17....	125	65		41¼
17	Wisconsin Blue (not inoculated).........	" 17....	125	51	1	18¾

EXPERIMENTS WITH ALFALFA.

The spring of 1909 was a trying one on alfalfa. The relative hardiness of the Turkestan and the common alfalfa was made evident, also that inoculated alfalfa, being better developed, is in better condition to withstand such trying conditious than is uninoculated alfalfa. The inoculated part of the acre of common alfalfa, which

was sown in 1907 and which yielded 7,200 pounds of hay in 1908, killed considerably but made a fair stand. The uninoculated area was completely killed out. Two plots of about one half-acre each were seeded in 1908 on another part of the Farm. One was common alfalfa and the other was Turkestan and both received similar treatment. The plot of Turkestan alone survived the spring. Soil from a field which had grown inoculated alfalfa one year was used to inoculate both plots, the soil on which the alfalfa was to be sown being black clay loam fall-ploughed out of oat stubble. The inoculation did not take evenly, the crop showing irregular growth and yielding only a little over a half ton per acre. In another case, where the seed bed was in better condition, soil from the same field effectively inoculated the new area. The conclusion is, that it is unsafe to use soil for inoculating from a field which has been inoculated but which has grown the alfalfa but one year. Another lesson which may be drawn is, that the seed-bed should be in the best of condition, preferably a summer-fallow of the previous year or fall-ploughed stubble, well worked till June, when the alfalfa may be sown.

Three plots of Turkestan alfalfa were sown in 1908, on land that had been used for a garden for some years. This land had received applications of barnyard manure in previous years and was in a good state of cultivation. One plot was inoculated with soil from a field which had grown inoculated alfalfa but one year. One plot was inoculated by means of culture from the laboratory in connection with the Department of Agriculture of the province. One plot was not inoculated. Following are the results:—

ALFALFA—Inoculation with Soil and with Culture.

—	Cutting Date.	Green per Acre.		
		Un-inoculated.	Inoculated with Soil.	Inoculated with Culture.
		Lbs.	Lbs.	Lbs.
First cutting	July 22	6,300	8,700	5,220
Second cutting	Sept. 11	1,920	1,860	1,560
Total		8,220	10,560	6,780

—	Cutting Date.	Dry per Acre.		
		Un-inoculated.	Inoculated with Soil.	Inoculated with Culture.
		Lbs.	Lbs.	Lbs.
First cutting	July 22	3,300	4,260	2,700
Second cutting	Sept. 11	780	840	660
Total		4,080	5,100	3,360

Very dry weather reduced the yield of the second cutting.

Small amounts of seed of various hardy sorts of alfalfa were received from the Central Experimental Farm and sown this season. A six-acre field of Turkestan alfalfa was also started, so that, if successful, a quantity of fodder will be available for feed next winter.

GRASSES—RED CLOVER, ALSIKE AND TIMOTHY.

In 1908, twelve one-third acre plots were seeded to grasses and clovers. The seed of some of these varieties was not good and consequently the stand was poor and the yields were not as high as might have been expected under favourable conditions. The alsike and timothy plot was not seeded intentionally but made, nevertheless, a splendid crop of fine hay. There was in the alsike seed a small quantity of timothy which came on, making a very good combination, judging from the yield as well as from the quality of hay produced.

No.	Variety.	Yield per Acre.
		Lbs.
1	Timothy and Alsike	4,632
2	Red Top Grass	3,972
3	Brome Grass	3,702
4	Western Rye Grass	2,972
5	Red Clover	2,552
6	Timothy	2,474
7	Canadian Blue Grass	2,016
8	Orchard Grass	2,012
9	Kentucky Blue Grass	1,625
10	Turkestan alfalfa, (inoculation failed to take)	1,020
11	Common alfalfa	Winter-killed.
12	Meadow Fescue	Seed poor; no crop.

EXPERIMENTS WITH INDIAN CORN.

Seventeen varieties of Indian Corn were planted on black clay loam, on May 25, and two varieties on May 31. Manitoba No. 1 was also planted in a favoured location, where it produced a small quantity of seed.

The seed was planted in hills 2½ feet apart each way and the crop was cultivated each way during the early part of the season. The yield was computed from the product of two rows, each 66 feet long.

Indian Corn—Test of Varieties.

No.	Variety.	Date Sown.	Date Cut.	Height.	Condition when Cut.	Weight of green Fodder per Acre.	
						Tons.	Lbs.
1	Eureka	May 25	Aug. 28	70	Well tasseled	15	826
2	Longfellow	" 25	" 28	70	"	15	202
3	Compton's Early	" 25	" 28	74	Just tasseling	14	811
4	Angel of Midnight	" 25	" 28	71	"	13	717
5	Mammoth Cuban	" 25	" 28	69	Not tasseled	13	252
6	Champion White Pearl	" 25	" 28	72	"	12	1,555
7	Selected Leaming	" 25	" 28	72	Just tasseling	12	277
8	Wood's Northern Dent	" 25	" 28	70	Not tasseled	11	1,696
9	North Dakota White	" 25	" 28	67	Well tasseled	11	767
10	Salzer's all Gold	" 25	" 28	70	Not tasseled	10	1,141
11	Early Mastodon	" 25	" 28	68	"	10	792
12	Triumph	" 25	" 28	67	Just tasseling	10	211
13	Mercer	" 25	" 28	69	"	9	433
14	Northwestern Dent	" 25	" 28	67	Well tasseled	9	120
15	White Cap Yellow Dent	" 25	" 28	69	Just tasseled	8	1,271
16	Superior Fodder	" 25	" 28	70	Not tasseled	8	959
17	Davidson	" 25	" 28	60	Well tasseled	8	959
18	Manitoba No. 2	" 31	" 28	60	In silk	7	1,333
19	Manitoba No. 1 sown separately	" 31	Sept. 15	68	Ripe	9	4

EXPERIMENTS WITH FIELD ROOTS.

All the root crops of 1909 were grown on clay loam, ploughed after brome hay was harvested in 1908. The land was packed after the plough and well worked in the fall of 1908 as well as in the spring of 1909. The dry weather toward the close of the season checked late growth. The yields are computed from the weight of roots on two rows each 66 feet in length and 30 inches apart.

TURNIPS.

Twelve varieties were tested this year. The seed was sown in drills two and one-half feet apart and the young plants were thinned out to 10 or 12 inches apart in the row. The seed was sown on May 25 and June 8 and the roots were harvested October 27.

TURNIPS—Test of Varieties.

Number.	Variety.	Yield per Acre.				Yield per Acre.			
		1st Plot.		1st Plot.		2nd Plot.		2nd Plot.	
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.
1	Good Luck	13	136	435	36	7	124	235	24
2	Magnum Bonum	13	4	433	24	5	956	182	36
3	Halewood's Bronze Top	12	1,872	431	12	6	1,728	228	48
4	Bangbolm Selected	12	1,740	429	0	6	1,728	228	48
5	Hall's Westbury	12	684	411	24	6	1,860	231	0
6	Hartley's Bronze	12	24	400	24	7	388	239	48
7	Mammoth Clyde	11	1,232	387	12	7	1,180	253	0
8	Skirving's	10	592	343	12	5	824	180	24
9	Kangaroo	9	668	311	8	4	372	139	32
10	Jumbo	9	216	303	36	3	1,524	125	24
11	Carter's Elephant	8	1,556	292	36	4	1,504	158	24
12	Perfection Swede	7	1,180	253		4	844	147	24

MANGELS.

Ten varieties of mangels were sown on May 24 and June 7 in drills two and one-half feet apart. The stand of plants secured was not uniform but, when thinning was necessary, plants were left from 8 to 10 inches apart in the row. Both plots were pulled October 2.

MANGELS—Test of Varieties.

Number.	Variety.	Yield per Acre.				Yield per Acre.			
		1st Plot.		1st Plot.		2nd Plot.		2nd Plot.	
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.
1	Half Sugar White	7	1,312	255	12	3	336	105	36
2	Perfection Mammoth Long Red	6	276	204	36	3	864	114	24
3	Selected Yellow Globe	6	144	202	24	4	1,900	165	0
4	Mammoth Red Intermediate	5	1,748	195	48	2	1,280	88	0
5	Gate Post	5	428	173	48	3	1,524	125	24
6	Giant Yellow Intermediate	5	296	171	36	1	1,960	66	0
7	Giant Yellow Globe	4	1,966	166	6	3	1,788	129	48
8	Crimson Champion	4	1,834	163	54	2	1,280	88	0
9	Prize Mammoth Long Red	4	844	147	24	3	1,656	127	36
10	Yellow Intermediate	3	1,524	125	24	4	844	147	24

CARROTS.

Four varieties of carrots were under test. The seed was sown on May 24 and June 7 in drills two and one-half feet apart, and the young plants were thinned out to from 5 to 7 inches apart in the row. The roots were harvested October 2.

CARROTS—Test of Varieties.

Number.	Variety.	Yield per Acre.				Yield per Acre.			
		1st Plot.		1st Plot.		2nd Plot.		2nd Plot.	
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.
1	Mammoth White Intermediate	7	520	242	0	3	864	114	24
2	Improved Short White	7	256	237	36	3	1,128	118	48
3	White Belgian	7	124	235	24	3	1,392	123	12
4	Half-Long Chantenay	6	926	215	36	3	1,656	127	36

SUGAR BEETS.

Three varieties of sugar beets were under test. Two sowings were made, the first on May 24 and the second on June 2. The soil and cultivation were similar to those of the other root tests. An improvement in sugar-content is shown this year.

SUGAR BEETS—Test of Varieties.

Number.	Variety.	Yield per Acre.				Yield per Acre.				Per cent. Sugar in Juice.	Per cent. Solids in Juice.	Co-efficient of Purity.
		1st Plot.		1st Plot.		2nd Plot.		2nd Plot.				
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.	%	%	
1	Vilmorin's Improved	5	296	171	36	3	996	116	36	13·16	19 17	68·6
2	Klein Wanzleben	4	1,768	162	48	2	884	81	24	11·83	15·43	76·7
3	French Very Rich	4	448	140	48	3	1,656	127	36	13·33	16·47	80·9

POTATOES.

Twenty-five varieties of potatoes were under test this year. They were plantd on May 24 in rows 30 inches apart, and the cuttings were dropped from 12 to 14 inches apart in the row. Level cultivation was given throughout the season and, though the yields of tubers were not large, the quality has not been equalled in former years. The soil was a black clay loam, ploughed out of brome stubble after the hay was cut in 1908. The land was top-dressed with manure in the spring of 1908. In the fall of 1908 and the spring of 1909, thorough cultivation was given. There was no rot in any of these plots.

Roots and potatoes are being grown on brome grass sod, not because of its suitability for growing these crops, but because of the suitability of these crops for destroying brome grass.

The yield per acre was estimated from the product of two rows, each 66 feet long.

POTATOES—Test of Varieties.

Number.	Name of Variety.	Dug.	Average Size.	Quality.	Total Yield per Acre.	Yield per Acre. Marketable.	Yield per Acre. Unmarketable.	Form and Colour.
					Bu. Lbs.	Bu. Lbs.	Bu. Lbs.	
1	British Queen	Sept. 7	Small	Good	331 6	225 0	106 6	White, oval.
2	Everett	" 8	Medium	"	311 8	248 8	63 ..	Red, oval.
3	Country Gentleman	" 7	"	"	292 36	223 25	69 11	White, long.
4	Ashleaf Kidney	" 7	"	"	289 18	202 8	87 10	Pink, oval.
5	Morgan Seedling	" 9	"	"	287 6	218 6	69 0	Pink, long.
6	Rochester Rose	" 9	"	"	282 42	225 35	57 7	" "
7	Money Maker	" 9	"	Medium	275 0	235 0	40 0	White, long.
8	Table Talk	" 8	Small	Good	275 0	143 0	132 0	White, oval.
9	Holborn Abundance	" 8	Medium	"	273 54	207 40	66 14	" "
10	Empire State	" 9	"	"	268 24	202 17	66 7	" "
11	Gold Coin	" 9	"	Medium	267 18	192 14	75 4	" "
12	American Wonder	" 8	Large	"	265 6	243 5	22 1	" "
13	Irish Cobbler	" 9	Medium	"	264 0	190 0	74 0	White, round.
14	Reeves' Rose	" 9	"	Good	255 12	214 9	41 3	Red, oval.
15	State of Maine	" 9	"	"	242 0	193 0	49 0	White, oval.
16	Pioneer	" 9	Small	Medium	239 48	149 32	90 16	" "
17	Uncle Sam	" 8	Medium	Good	224 24	161 18	63 6	" "
18	Carman No. 1	" 9	"	Medium	223 18	187 14	36 4	" "
19	Dooley	" 8	Large	"	212 18	195 16	17 2	" "
20	Late Puritan	" 9	Medium	"	193 36	154 29	39 7	" "
21	Dalmeny Beauty	" 9	"	Good	190 40	159 34	31 6	White, long.
22	Uncle Gideon's Quick Lunch	" 9	Small	Medium	182 36	94 20	88 16	White, round; Pink eye.
23	Dreer's Standard	" 9	"	"	181 30	115 19	66 11	White, oval.
24	Twentieth Century	" 10	Medium	"	173 04	131 3	42 1	" "
25	Vicks Extra Early	" 9	"	Good	137 52	98 40	39 7	" "

APPLICATION OF FERTILIZERS TO POTATOES.

The following experiments with fertilizers as applied to potatoes were conducted. The superphosphate of lime and sulphate of potash for the plots of grain reported on on a previous page, and for the second in the series of potatoes treated with artificial fertilizers were kindly supplied by the Brackman-Ker Elevator Company, Alberta, representative of the Dominion Potash Syndicate, Toronto, Ontario.

POTATOES—Application of Fertilizezrs.

Variety.	Fertilizer.	Total Yield. Bush.	Total Yield. Lbs.	Yield per acre. Marketable. Bush.	Marketable. Lbs.	Unmarketable Bush.	Unmarketable Lbs.
Holborn Abundance	None	212	18	161	13	51	5
" "	561 lbs. Superpbospbate of Lime; 111 " Sulphate of Potash	270	36	237	30	33	6
Ashleaf Kidney	None	247	30	167	20	80	10
" "	330 lb.. Acid Pbosphate; 132 " Nitrate of Soda; 198 " Muriate of Potash; Sulphate of Potash 198 lbs.	280	30	224	24	56	6
" "	330 lbs. Acid Pbospbate; 132 " Nitrate of Soda	275	0	198	0	77	0

POTATOES—DEPTH OF PLANTING.

Country Gentleman potatoes were planted 2, 4 and 6 inches deep with the following results:—

POTATOES—Depth of Planting.

Variety.	Total Yield.		Yield per acre.			
			Marketable.		Unmarketable	
	Bush.	lbs.	Bush.	lbs.	Bush.	lbs.
Country Gentleman—						
2 inches deep	299	12	227	8	72	4
4 " "	312	24	249	21	63	3
6 " "	246	24	206	22	40	2

APPLE ORCHARD.

The apple trees made a good growth during the season of 1909, and most varieties ripened their wood fairly well. None of the trees are of bearing age.

SMALL FRUITS.

The fruit bushes set out in 1907 were permanently placed in 1909. Small quantities of red and black currants and red raspberries were produced. The fruit was of good size and fine quality. The strawberry plantation, set out in 1908, fruited this year and produced berries of great size and fine flavour. The stand of plants was uneven, hence the yield was not as heavy as might otherwise have been expected, but the berries were very large, one reaching 7¼ inches in circumference. The varieties yielding the highest were Senator Dunlap, Beder Wood, Haverland, Ruby and Glen Mary. The single hedge-row system was tried in comparison with the matted-row system. The matted-row system gave the larger yields this year in every instance. The season extended from July 10 to August 15.

TREE PLANTING.

Four miles of trees were planted around the boundaries of the Farm, which completed the circuit with the exception of three rows about one-quarter of a mile long. The varieties used this year were Ash and Manitoba Maple for the two rows next to the line fences. The third row was planted with the idea of lending variety to the border. Among the shrubs planted, Loniceras, Syringas, Spireas and Caraganas are prominent, while different varieties of Spruce and Pine are the most important of the trees planted in this row.

THE VEGETABLE GARDEN.

The season was favourable for the growth of vegetables. The following varieties were tested and are named in order of merit.

Beans—
- Golden Wax,
- Matchless,
- Emperor of Russia,
- Every Day,
- Flageolet,
- Edible Podded.

Beets—
- Egyptian,
- Nutting's Dwarf Improved,
- Half-long,
- Long Smooth Blood.

Carrots—
French Horn,
Improved Nantes.
Cabbage—
Large Flat Drumhead,
Early Jersey Wakefield,
Fottler's Improved Brunswick.
Onions—
Paris Silverskin,
Extra Early Red,
Large Red Wethersfield.
Radish—
Olive Scarlet,
Turnip Forcing,
Turnip Scarlet.

Celery—
Paris Rose-ribbed,
Giant Pascal.
Cauliflower—
Early Snowball,
Extra Early Select Erfurt.

Lettuce—
Cos Trianon,
Neapolitan,
Wheeler's Tom Thumb.
Peas—
Melting Marrow.
Table Turnips—
Extra Early White Milan.

FLOWER GARDEN.

This year the flower garden succeeded well and bloom was good till the last of September. The seed was sown in the hot-bed on April 29, and the plants were set in the open ground June 23. The seed of Larkspur, Mignonette, Poppy and Sweet Peas was sown in the open.

Variety.	Sown in hot-bed.	Planted in open.	Remarks.
Asters	April 29	June 23	Fine bloom.
Brachycome	" 29	" 23	"
Balsam	" 29	" 23	"
Candytuft	" 29	" 23	"
Coreopsis	" 29	" 23	"
Dianthus	" 29	" 23	"
Eschscholtzia	" 29	" 23	"
Godetia	" 29	" 23	"
Larkspur	In open	In open	"
Mignonette	"	"	"
Poppy	"	"	"
Sweet Peas	"	"	"

PANSIES.

This season produced the finest pansies we have had. The varieties worthy of special mention are Lord Beaconsfield, Giant Trimardeau and Giant Hercules.

BULBS.

Owing to the fact that the bulbs were planted after the land was frozen in the fall of 1908, they did not produce roots till spring. The bloom was not strong, the Tulips being only fair, while the Crocuses and Snowdrops were a failure.

CATTLE.

The two dairy cows have been in good health during the year. There is also one heifer two years old and a heifer calf, both of which are in good condition.

FEEDING FOR BEEF.

With the view of maintaining the fertility of the land and at the same time of finding a use for a quantity of frosted spring wheat which was being held over from 1907, and which was not marketable at more than 35c. per bushel, a car load of steers were purchased and put on feed in December, 1909. Besides the frosted wheat, the screenings from the oats and barley used for seed constituted a small proportion of the grain ration. Upland prairie hay was fed during the first ten weeks and timothy hay at the finish. The hay was fed in racks which were kept full. The change from upland to timothy was not made out of preference for the latter, for it is believed that well cured upland hay will give as good, if not better, results than well-cured timothy. The cost is figured at the market value of these hays in Lacombe at the time they were being fed. Three dollars per ton is rather above the cost of upland hay to most feeders, whereas $6 for upland and $7 per ton for timothy is charged against this bunch of cattle. The cost of chop is fixed at 40c. per bushel of 60 pounds or ⅔ of a cent per pound. This, while a lower figure than good chop is worth, is sufficient to pay for the cost of grinding and handling and pay the market price for frosted wheat of 35c. per bushel. Chop made from fully matured or only slightly frosted grains would have produced better gains than were secured from this grain, which was badly frozen.

The cattle were two and three-year-olds, a mixed bunch as regards breed and also as to adaptability for feeding. Shorthorn, Hereford and Galloway bloods were represented. A lot averaging much better could have been secured earlier in the season, as the best feeders had been picked up by the date these were secured. Twelve were put on feed December 8, four on December 15 and three December 23, making a total of nineteen head. One steer died during the test. They averaged 1,130 pounds and cost 3½c. per pound, weighed on arrival. Freight charges and travelling expenses brought the cost up to 3·658 cents per pound, or $744.01. Grain was fed in the beginning at the rate of 3 pounds per head per day, and was gradually increased until by February 26 they were getting 16½ pounds per head per day. This was practically full feed and, during warm weather, had to be reduced, as the aim was to feed only what they would clean up in an hour.

They were fed outside in the corral and had access to a shed which was seldom used. The only expense was for lumber to build hay racks, grain tables, and for a water tank and tank heater which prevented the formation of ice on the water. The total cost of time was 222 hours. The time necessary is evidence that outside feeding may be carried on at small expense for labour as well as for equipment.

The following table gives the results:—

SUMMARY OF RESULTS.

Number steers in lot		18
Gross weight weighed in	lbs.	20,337
Average weight per head weighed in	"	1,130
Number of days fed		109
Gross weight weighed out March 30	lbs.	23,720
Average weight weighed out March 30	"	1,318
Total gain in 109 days	"	3,383
Average gain per head	"	188
Average daily gain per head	"	1·72
Average cost per 100 pounds gain	$	7 42
Value per bushel of frozen wheat fed and marketed as beef		1 28½
Interest on investment for buildings and necessary shelter		——

View of Barn—Experimental Farm, Lacombe, Alta.

COST.

18 steers average weight 1,130 pounds at 3·658 cents per lb.	$ 744 01
26,216 pounds prairie hay at $6 per tou	78 65
9,123 pounds of timothy hay at $7 per ton	31 93
20,810 pounds frozen wheat chop at ⅔ of one cent per lb.	138 73
145 pouuds salt	1 75
The cost of 222 hours of labour and interest ($18.75) on money invested in cattle is not figured, but it is more than covered by value of manure available for application on the land.	
Total cost	$ 995 07

RECEIPTS.

Sold 18 steers, total weight 23,720 pounds, 23,720 pounds less 5 per cent at $5.75 per 100 pounds	$1,295 70
Profit on gaiu of two pigs following steers during last six weeks of feeding	4 75
Total receipts	$1,300 45
Total cost	995 07
Total profit	$ 305 38
Average profit per head	$ 16 97
NOTE.—Loss of one steer, 1,130 pounds at 3·658 cents plus value of hay and chop consumed	$49 69
Less 51 pounds hide at 5 cents per lb.	2 55
	$47 14
Profit of $305.38, less $47.14	$258 24
Average profit per head after covering this loss	14 35

Perhaps a few conclusions may be safely drawn from this work.

1. Expensive equipment is unnecessary as outside feeding is profitable.

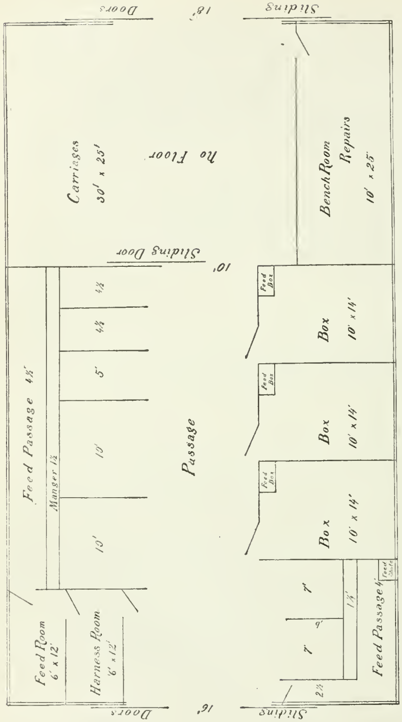
2. Frozen wheat or other grain otherwise unsaleable or only as low grade may be marketed on foot at a good price.

3. When mixed farming is practised and the grain produced is fed and the manure returned to the land, there is no dangerous deterioration of the fertility of the soil. The additional source of revenue caused by feeding a part of the grain produced on the farm constitutes an element of safety. The time to commence to conserve the fertility of the soil is before the need of such conservation becomes evident.

4. It is safer to bring steers three years old to full feed than steers two years old. This must not be understood as a statement that all two year old steers will not stand full feed. It will depend on the constitution of the individual animal. Two two-year-old steers could not stand the amount of feed that the three-year-olds handled without difficulty. One of these gradually failed and finally constituted a loss, while the second was brought back to fair gains after some difficulty.

HORSES.

The four heavy horses have been in good health during the year. The average 7 feet and ½ inches in girth and 1,685 pounds in weight. During the year they have



Barn 40 x 70
Scale 5' to 1"

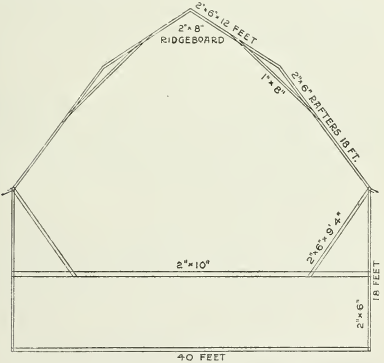
GROUND PLAN OF BARN, EXPERIMENTAL FARM LACOMBE.

worked 3,178 hours. The general purpose team are in good health as is also the heavy draught filly two years old.

PLAN OF BARN.

The plan of the barn is presented herewith. The feature which is considered most deserving of attention is the self-supporting hip roof which provides more space for the money than any other style of roof with which the writer is familiar. Though subjected to the strain of a number of high winds it has so far given no sign of weakness and carries an unloading track without difficulty.

As shown in the plan, the first run of rafters is 18 and the second run 12 feet in length, giving a total length of rafter of 30 feet on each side of the barn. The rafters are 2 inches x 6 inches and are set at 2 feet centres. The two runs constituting the side are securely nailed together before being raised. The proper pitch being secured, stakes are driven into the ground on both sides of each end of each run, then one of the ties at the break is nailed. This method insures all the rafters being exactly the same pitch without taking time to determine pitch for each pair. The 2-inch x 8-inch plank at the ridge, from which the track is later hung, is held in place from a scaffolding erected inside the barn, the rafters are raised and spiked securely to this plank. The loft in this barn is 28 feet from ceiling above the horses to ridge and will hold a large amount of feed.



The studding is also 2-inch x 6-inch 2-foot centres, the ties from the wall to the joist are 2 inches x 6 inches and 6 feet apart. The joist are 2 inches x 10 inches on 2-foot centres. The building stands on four concrete walls.

There is a large bias over feed room for storing, connected with the latter by a stop spout feeding into a small box.

Manger 1½ feet wide at the bottom, sloping inward towards passage.

The barn was built in 1907 at a cost of $2,031 complete. The lumber, hardware, building paper, gravel and cement were estimated to cost $1,524.65 and labour the balance. $506.35. Gravel cost $3 per yard delivered, while lumber and cement were also high-priced. No. 1 material only was used.

CORRESPONDENCE.

From April 1, 1909, to March 31, 1910, 4,248 letters were received and 3,571 answered.

MEETINGS ATTENDED.

This Farm was represented at the Edmonton Exhibition, occupying a tent on the grounds. An exhibit of alfalfa growing, alfalfa hay, alfalfa meal and weed seeds commonly found in alfalfa seed was made. Charts giving the results of certain experiments were also a feature, and literature was available to those interested. The tent was visited by a large number of farmers.

I attended the Irrigation Convention at Lethbridge, Alta., on August 6, and from there judged the standing fields of grain entered in the competitions held by the Raymond and Innisfail Agricultural Societies. I also assisted in judging the Good Farms Competition held by the Red Deer Agricultural Society. I acted as judge and spoke at the seed fairs held at Edmonton, Leduc, Daysland, Sedgewick, Irma. Red Deer, Bowden, Olds, Didsbury, and the Provincial Seed Fair at Edmonton. I delivered six lectures in connection with the short course conducted by the Provincial Department of Agriculture at Olds.

EXCURSION.

On July 20 an excursion visited the Farm. Special trains were run from Calgary and Edmonton, the regular Wetaskiwin branch train connecting with the special. The Provincial Department of Agriculture did the advertising and arranged the reduced fares. The number of people visiting the Farm was not large, totalling about seven hundred. Addresses were delivered by Senator Talbot, George Harcourt, W. C. McKillican, H. A. Craig, W. F. Stevens and the Superintendent. The visitors were also shown over the Farm as thoroughly as possible in the time at their disposal.

ACKNOWLEDGMENT.

At the close of last year Mr. C. E. Craig, who had efficiently discharged the duties of foreman for two years, left to undertake the management of a fruit farm in British Columbia. Mr. R. E. Everest has since been satisfactorily occupying this post. Mr. S. Edmunds, who has been employed on the Farm from the first, has earned my thanks for his careful and interested work.

DISTRIBUTION OF SAMPLES.

One hundred and ten thousand seedlings of Manitoba Maple and Caragana were distributed in the spring of 1909. There are about 100,000 ready for distribution in 1910.

The number of applications for grain and potatoes have increased over those of last year when 195 samples were distributed. The following have been sent out during the year.

Winter wheat	181
Spring wheat	264
Oats	219
Barley	110
Potatoes	541
Total	1,315

BUILDINGS.

An extension to the machine shed was erected This addition is 50 feet long by 20 feet in width.

METEOROLOGICAL RECORD.

Months.	Highest Temperature.	Date.	Lowest Temperature.	Date.	Total Precipitation.	Total Hours Sunshine.
1909.						
April	58 3	25th	3·9	12th	·275	213·
May	81·3	3rd	16 9	8th	2·63	199·4
June	80	16th	30 9	7th	2·24	313·7
July	82·8	22nd	37·6	20th	4·28	300·
August	86·5	14th	29·4	28th	·91	325·2
September	84·5	6th	23·9	27th	·43	227·1
October	76·1	5th	9 8	11th	1·05	143·5
November	53·6	2nd	—19·	25th	·37	113·5
December	45·	29th	—23·1	7th	·82	90·3
1910.						
January	47·1	30th	—24·1	1st	·73	115·6
February	41·1	4th	—38·	21st & 22nd	·59	155·
March	65·6	22nd	— 5·5	1st	·33	202·9
Totals					14·655	2,399·2

I have the honour to be, sir,

Your obedient servant,

G. H. HUTTON,

Superintendent.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA

REPORT OF THOS. A. SHARPE, SUPERINTENDENT.

AGASSIZ, B.C., March 31, 1910.

To Dr. WM. SAUNDERS, C.M.G.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to present herewith my report for the year ending March 31, 1910.

The winter of 1908-9 was the severest for many years and the spring was late, with cold drying winds from the north, northeast and northwest. This weather was very trying to the meadows, which had already sustained considerable injury from the ice-covering which lay over them for two weeks in January. Newly-seeded clover was almost destroyed by the heaving of the wet ground, from the frosts of January and February.

The cold, drying winds continued, with a very light rainfall until well on in June, when the weather became warmer and more summer-like, but still dry, the rainfall being very light until the harvest was well forward.

Owing to the unfavourable winter and spring, the hay crop in 1909 was the lightest in many years. The grain crops were fairly good and the grain was plump and harvested in good condition. As usual, the Indian corn did not make very much growth until July, and, as a consequence, it was very immature when cut for filling the silo, very few varieties being farther advanced in growth than to the formation of ears and none produced good ears of glazed corn.

November was the wettest on record, our rainfall for that month being 20·88 inches and the land was flooded as the greater portion of the month's precipitation came in the last few days.

December was mild and the rainfall comparatively light. January, February and March have been mild, the lowest temperature for the winter having been 10 degrees above zero, on February 21 and 22.

March throughout has been cool, cloudy and showery with less than the average amount of sunshine. Growth, which in the beginning of the month promised to be early, has been backward. The grass has not grown much, a few varieties of trees show leaves and only the Japanese plums are in bloom at the close of the month.

FALL WHEAT.

Seven varieties of fall wheat were sown in the variety test. The previous crop was clover, the first cutting of which was made in June and the aftermath turned under in August. The land was tilled with the disc and spike-toothed harrows. The seed was sown at the rate of one and one-half bushels per acre. It was treated with formalin to kill all smut germs and sown September 16. The seed germinated well and the stand was promising, but when the ground was very wet early in January,

we had a [illegible] accompanied with a cold rain which formed a sheet of ice from 2 to $3\frac{1}{2}$ inches thick. This remained on the ground nearly two weeks and the fall wheat crop was destroyed.

FALL RYE.

Four varieties of fall rye were sown on October 7 alongside of, and on soil treated the same way as for the fall wheat tests.

The seed was treated with formalin and was sown at the rate of one bushel and a peck per acre; it germinated well and the promise of a crop was very good, but the ice smothered it as it did the wheat, and the land was resown to spring grain.

There is not enough rye grown in this locality to load a car for shipment and the grain is not relished as a feed by any class of stock; there is no market for rye straw so that this grain is not of value here, except as a soiling crop in spring.

EXPERIMENTS WITH SPRING WHEAT.

Twelve varieties of spring wheat were grown in the test series this year. The seed was treated with formalin before sowing and all plots, which were one-fortieth of an acre each, were sown on April 8, at the rate of one and one-half bushels per acre. They were located in one of the apple orchards which had a cover crop of clover ploughed down in June of the previous year and a light dressing of stable manure applied in the autumn. This was well disced into the soil before the wheat was sown. Although there was some injury by the midge and also by the shade of the apple trees, yet the yield was fair and the grain plump and bright, as the weather was favourable before and during harvest.

No smut or rust was observed on any of the varieties.

SPRING WHEAT—Test of Varieties.

Number.	Name of Variety.	Date of Ripening.	No. of days Maturing.	Average length of Straw including Head.	Character of Straw.	Average length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Ins.		Ins.		Lbs.	Bush.	Lbs.	Lbs.
1	Pringle's Champlain..	Aug. 16.	122	48	Strong....	3	Bearded..	3,910	28	57	$62\frac{1}{2}$
2	Percy......	" 17.	123	46	" ...	$3\frac{1}{2}$	Beardless.	3,900	24	36	62
3	Preston......	" 20	126	46	" ...	4	" ..	3,650	24	18	$64\frac{1}{2}$
4	Stanley..............	" 20.	126	48	" ...	$3\frac{1}{3}$	" ..	4,287	24	15	61
5	Bishop.....	" 21.	127	44	Medium..	$3\frac{1}{2}$	" ..	4,503	23	15	63
6	Red Fife.............	" 21.	127	45	Strong ...	3	" ..	4,261	22	05	$62\frac{1}{2}$
7	Marquis..............	" 16.	122	42	Medium..	3	" ..	2,995	21	43	64
8	Huron..	" 20.	126	45	Strong ...	3	Bearded..	3,575	21	8	$61\frac{1}{2}$
9	Chelsea....	" 21.	127	43	" ...	3	Beardless.	4,085	20	30	$64\frac{1}{2}$
10	White Fife	" 21	127	40	Medium..	3	" ..	4,355	20	21	$62\frac{1}{4}$
11	Hungarian White....	" 23.	129	46	Strong ...	3	Bearded..	3,740	20	6	64
12	Riga	" 21.	127	42	Medium..	3	Beardless.	3,160	19	0	64

EXPERIMENTS WITH OATS.

Twenty-two varieties of oats were sown on April 19 at the rate of $2\frac{1}{2}$ bushels per acre. The seed was treated with formalin and the crop was free from smut or rust. The plots were located in one of the apple orchards on a sandy loam soil, clover being sown with the oats. The yield was much more uniform than that of last year; the

straw was bright and stiff and the grain plump, owing to the favourable weather. The plots were each one-fortieth of an acre in size.

OATS—Test of Varieties.

Number.	Name of Variety.	Date of Ripening.		No of Days Maturing.	Length of Straw Including Head.	Character of Straw.	Length of Head.	Kind of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
					Inch.		Inch.		Lbs.	Bush.	Lbs.	Lbs.
1	Improved American..	Aug	16	119	48	Strong.	10	Branching	2,140	90	24	36
2	Tartar King.........	"	12	115	43	"	10	Sided....	2,660	90		36
3	Milford White.....	"	16	119	44	"	9	"	2,640	89	14	38
4	Banner.....	"	19	119	45	"	9	Branching	2,520	88	8	38
5	Virginia White.......	"	13	113	49	"	10	"	2,660	87	22	35
6	Kendal White.......	"	16	119	50	"	11	Sided-....	2,760	85	30	35
7	Thousand Dollar	"	16	119	42	"	10	Branching	2,840	83	18	40½
8	Abundance..........	"	14	117	48	"	11	"	2,280	82	12	39
9	Improved Ligowo....	"	13	116	44	"	10	"	2,600	82	12	40½
10	Lincoln.	"	16	119	47	"	10	"	2,290	80	30	34¾
11	'Regenerated' Abundance	"	13	116	48	"	11	"	2,540	80	20	41½
12	Swedish Select.	"	12	115	44	"	10	"	2,640	80	—	35½
13	Irish Victor..........	"	12	115	48	"	10	"	2,140	80	—	35
14	White Giant,.........	"	16	119	41	"	10	"	2,720	77	22	37
15	Twentieth Century...	"	12	115	43	"	10	"	2,506	75	30	38½
16	Siberian	"	17	120	46	"	10	Sided... ..	2,820	74	4	38
17	Storm King.........	"	16	119	46	"	11	"	3,100	72	12	36
18	Golden Beauty.......	"	18	121	42	"	9	Branching	3,280	71	26	33½
19	Pioneer.........,....	"	12	115	44	"	10	"	3,280	70	20	40¾
20	American Triumph...	"	12	115	48	"	11	"	3,140	70	6	37
21	Wide Awake	"	17	120	42	"	10	"	3,200	64	24	40¾
22	Danish Island........	"	17	120	46	"	11	"	2,960	63	18	39½

EXPERIMENTS WITH BARLEY.

Ten varieties of six-rowed and ten varieties of two-rowed barley were sown in the test plots this year, on April 19. The seed was treated with formalin and sown at the rate of two bushels per acre. The land had been in Indian corn the previous year and had received a dressing of stable manure for that crop.

The growth was strong, the grain plump and the yield fairly good. No smut or rust was observed on any of the plots, which were each one-fortieth of an acre. The soil was a sandy loam.

SIX-ROWED BARLEY—Test of Varieties.

Number.	Name of Variety.	Date of Ripening.		No. of days Maturing.	Length of Straw, including Head.	Character of Straw.	Length of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
					Inches.		Inches.	Lbs.	Bush.	Lbs.	Lbs.
1	Nugent	Aug.	9	112	40	Medium..	2½	3,000	55	40	47½
2	Odessa	"	2..	105	43	Strong ...	3	2,840	54	8	50½
3	Oderbruch................	July	31.	103	42	" ..	3½	3,410	51	2	52
4	Stella	Aug.	6 .	109	42	Medium..	3	3,200	50	40	51
5	Yale.	"	2..	105	46	Strong ...	3	2,910	50	30	52½
6	Mensury..........	"	4..	107	44	" ...	3½	2,980	50	20	47¾
7	Trooper	"	5..	108	40	Medium..	3	2,760	43	6	
8	Mansfield	"	4..	107	42	" ..	3½	2,760	42	24	50
9	Claude............	"	4..	107	40	Weak	3	3,400	35	40	52½
10	Albert	"	3..	106	40	"	2½	3,420	34	28	52

Two-rowed Barley—Test of Varieties.

Number.	Name of Variety.	Date of Ripening.	No. of days Maturing.	Length of Straw, including Head.	Character of Straw.	Length of Head.	Weight of Straw.	Yield per Acre.		Weight per measured Bushel after Cleaning.
				Inches.		Inches.	Lbs.	Bush.	Lbs.	Lbs.
1	Canadian Thorpe	Aug. 10..	113	46	Strong....	4	3,280	55		53½
2	Beaver	" 7..	110	40	" ...	4	2,940	53	36	54½
3	Danish Chevalier	" 9..	112	44	" ...	5	3,260	51	12	53
4	Swedisb Cbevalier	" 12..	115	44	Medium..	4	2,900	49	28	50
5	Standwell	" 9..	112	45	Strong....	5	3,080	49	8	51½
6	Jarvis	" 9..	112	41	" ...	5	3,360	46	32	50½
7	Invincible	" 11..	114	46	" ...	5	2,840	45	40	53½
8	Frencb Chevalier	" 11..	114	44	Medium..	4½	3,060	40	20	50¾
9	Gordon	" 7..	110	43	" ..	4	2,920	36	32	50½
10	Clifford	" 7..	110	40	Strong....	3	3,240	35	40	54

EXPERIMENTS WITH PEAS.

Fifteen varieties of peas were included in this test in 1909. All were sown April 19 cn freshly-ploughed clover sod. There had been a heavy aftermath of clover covering the ground in the fall of 1908, which was starting growth when turned under in the spring of 1909. All plots were one-fortieth of an acre in size.

The large varieties were sown at the rate of three bushels per acre and the small at the rate of two and one-half bushels. All varieties were well podded and the pods well filled except the Arthur, which was not so well podded as the other varieties this year.

A half-acre plot of Golden Vine peas was sown on the same date and harvested August 20, yielding at the rate of 55 bush. 10 lbs. per acre.

Peas—Test of Varieties.

Number.	Name of Variety.	Date of Ripening	Number of days Maturing.	Character of Growth.	Average length of Straw.	Weight of Straw.	Average length of Pod.	Size of Pea.	Yield per Acre.		Weight per measured Bushel after Cleaning.
					In.	Lbs.	In.		Bush.	Lbs.	Lbs.
1	Mackay	Aug. 18	121	Strong..	60	2,440	3	Medium	54	40	63½
2	White Marrowfat	" 21	124	" ..	56	2,400	3	Large...	49	20	63
3	Paragon	" 23	126	" ..	64	3,120	3½	" ..	46	40	64¼
4	English Grey	" 21	124	" ..	54	2,900	3	Medium	46	20	63
5	Wisconsin Blue	" 14	117	" ..	60	2,960	3	Small ..	45	20	63½
6	Daniel O'Rourke	" 16	119	" ..	50	2,480	2½	" ..	42	40	63¾
7	Early Britain	" 16	119	" ..	54	3,140	3	Medium	42	40	62¼
8	Prince	" 18	121	" ..	56	3,360	3	Large...	42		63
9	Prussian Blue	" 19	121	" .	53	3,000	3	Medium	41		64½
10	Picton	" 21	124	" ..	52	3,660	3	"	40	20	64
11	Victoria	" 21	124	" ..	53	3,200	3	"	40		64
12	Black-eye Marrowfat	" 19	121	" ..	56	3.480	3½	Large...	36	40	63½
13	Chancellor	" 19	121	" ..	52	4,000	3	Small ..	34		65
14	Gregory	" 20	122	" ..	54	4,640	3½	Large...	30		64
15	Arthur	" 14	117	Weak ..	49	3,600	2½	Medium	27	20	63½

EXPERIMENTS WITH INDIAN CORN.

Fourteen varieties of Indian corn were planted for ensilage on May 25. The seed was coated with coal-tar to protect it from crows. The corn was planted in drills and in hills, both 36 inches apart. The drills were thinned to one stalk every ten inches and the hills to three stalks in a hill. The land was clover sod and the corn made a strong, leafy growth but, owing to the coldness of the season, only one variety, the Davidson, matured ears to the glazing stage, while several did not form ears. The varieties were all harvested October 14 and 15.

The yields per acre were estimated from the product of two rows, each 66 feet long.

Indian Corn—Test of Varieties.

Number.	Name of Variety.	Character of Growth.	Height.	When Tasseled.		In Silk.		Condition when Cut Oct. 14.	Weight per Acre grown in Rows.		Weight per Acre grown in Hills.	
			Inch.						Tons.	Lbs.	Tons.	Lbs.
1	Superior Fodder......	Very Strong.	116	Aug.	14	Sept.	14	Ears formed..	22	1,980	24	860
2	Wood's Northern Dent.	" "	126	"	20	"	23	" "	22	1,760	24	730
3	Salzer's All Gold.....	" "	110	"	30	"	28	" forming..	22	1,100	20	1,910
4	White Cap Yellow Dent	" "	124	"	19	"	20	" formed...	22	220	17	1,970
5	Comptons Early......	" "	116	"	13	"	7	Early Milk....	21	240	22	220
6	Longfellow..	" "	116	"	14	"	9	" "	21	20	22	110
7	Angel of Midnight....	" "	107	"	11	"	13	" "	20	1,140	17	320
8	Early Mastodon.......	" "	123	"	30	"	27	Ears forming.	18	1,730	17	1,420
9	Mammoth Cuban......	" "	118	"	30	"	30	" "	18	1,620	21	1,670
10	Champion White Pearl	" "	104	"	4	"	7	Late Milk....	17	1,640	18	1,180
11	North Dakota White..	" "	106	"	18	"	22	Early Milk....	17	700	18	190
12	Eureka...............	Strong........	120	"	31			In Silk........	17	540	20	1,360
13	Davidson..............	Medium.....	86	"	1	"	4	Glazed.. .	16	560	16	1,220
14	Selected Leaming......	Strong........	110	"	20	"	28	Early Milk...	15	1,570	16	450

Indian Corn—Sown at Different Distances Between Rows.

The same varieties were used as in previous years, Longfellow, Champion White Pearl and Selected Leaming. The plots were sown alongside of, and under the same conditions of soil and cultivation as the other test plots.

As in previous tests, the closely-planted plots gave the heaviest yields, but the corn was very immature and unfit for ensilage. The plots sown at three feet apart were more mature, the ears larger and better developed than in the plots sown closer together, and a better yield was obtained than in the plots sown 42 inches between rows. There is a distinct loss in yield in the test at 42 inches apart, and no gain in development over the plot planted at 35 inches apart.

All the plots were planted May 25 and cut October 14 and 15. The yield per acre is estimated from the yield of two rows, each 66 feet long.

INDIAN CORN—Sown at Different Distances Apart.

Name of Variety.	Distance Apart.	Weight per Acre grown in Rows		Weight per Acre grown in Hills.	
	Inches.	Tons.	Lbs.	Tons.	Lbs.
Longfellow	21	19	1,977	21	428
"	28	16	670	16	1,660
"	35	17	395	16	926
"	42	15	503	14	191
Champion White Pearl	21	19	1,600	17	1,074
" "	28	16	528	17	933
" "	35	16	135	14	964
" "	42	15	643	11	540
Selected Leaming	21	18	1,337	17	1,074
"	28	17	1,216	16	1,520
"	35	16	1,718	16	359
"	42	14	945	15	423

EXPERIMENTS WITH TURNIPS.

Twelve varieties of turnips were sown in this test in 1909. The land, a sandy loam, had produced a crop of clover in 1908, which had been top-dressed with stable manure. The land was ploughed after the first crop of clover was removed and rolled and harrowed, the latter operation being repeated several times during the autumn to destroy the sprouted weed seeds, and was in fine condition when the first sowing was made May 8, a second sowing being made May 22.

The drills were 24 inches apart and the plants were thinned to ten or twelve inches apart in the row. The roots were solid and well shaped. The yield per acre in each case was estimated from the product of two rows, each 66 feet long. All were pulled October 30 and November 1.

There was more moisture in the soil when the first sowing was made, which probably resulted in quicker germination, a more even stand and a heavier yield in most cases for the earlier sowing.

TURNIPS—Test of Varieties.

Number.	Name of Variety.	Yield per Acre. 1st Plot.		Yield per Acre. 1st Plot.		Yield per Acre. 2nd Plot.		Yield per Acre. 2nd Plot.	
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.
1	Perfection Swede	43	460	1,441		34	300	1,138	20
2	Carter's Elephant	42	1,635	1,427	15	32	1,775	1,086	15
3	Mammoth Clyde	42	480	1,408		38	1,860	1,331	
4	Halewood's Bronze Top	41	1,985	1,398	5	34	1,300	1,138	20
5	Hartley's Bronze	41	1,820	1,347		42	810	1,413	30
6	Good Luck	41	1,160	1,386		37	1,240	1,254	
7	Hall's Westbury	41	830	1,380	30	38	1,880	1,298	
8	Bangholm Selected	40	420	1,340		33	1,970	1,132	50
9	Jumbo	37	1,450	1,256	45	33	1,140	1,119	
10	Kangaroo	36	1,930	1,232	10	25	1,665	860	45
11	Magnum Bonum	35	1,280	1,188		28	100	935	
12	Skirving's	34	1,940	1,166		38	1,800	1,298	

EXPERIMENTS WITH MANGELS.

Ten varieties of mangels were sown in the uniform test plots in 1909. Two sowings of each variety were made, the first on May 8 and the second on May 22, in drills 24 inches apart, and the plants thinned out to about ten inches apart in the drills. All were harvested October 28 and 29.

The roots were very smooth and even in size and the yield was heavier than in the two previous years, as the land, a sandy loam, had been manured the previous season and had been well prepared before sowing.

The yield per acre was calculated from the product of two rows, each 66 feet long.

MANGELS—Test of Varieties.

Number.	Name of Variety.	Yield per Acre.							
		First Plot.				Second Plot.			
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush	Lbs.
1	Perfection Mammoth Long Red	38	1,220	1,287		34	640	1,144	
2	Mammoth Red Intermediate	35	1,280	1,188		33	990	1,116	30
3	Giant Intermediate	33	1,320	1,122		30	520	1,008	40
4	Selected Yellow Globe	33	660	1,111		30	1,380	1,023	
5	Yellow Intermediate	31	1,690	1,061	30	35	1,280	1,188	
6	Prize Mammoth Long Red	30	720	1,012		24	1,005	816	45
7	Gate Post	26	965	882	35	25	1,480	858	
8	Crimson Champion	26	800	880		25	160	836	
9	Half Sugar White	25	1,810	863	20	24	180	803	
10	Giant Yellow Globe	25	1,480	858		39	1200	1,380	

EXPERIMENTS WITH CARROTS.

Six varieties of carrots were grown in the test plots this year. The seed was sown in drills two feet apart, and the plants were thinned out to about six inches apart in the row. The first sowing was made on May 8 and a second on May 22. All were harvested on November 4.

The soil was a warm sandy loam on which clover had been grown the previous year, the second growth being ploughed under.

The yield, which was much better than that of 1908, has been calculated from the product of two rows, each 66 feet long.

The shorter varieties were found to be the better, as they are good croppers and are easier to harvest. The White Belgian is more liable to break and then does not keep so well.

CARROTS—Test of Varieties.

Number.	Name of Variety.	Yield per Acre.							
		First Plot.				Second Plot.			
		Tons	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.
1	Improved Short White	37	250	1,237	30	36	280	1,204	40
2	White Vosges	34	640	1,144		31	865	1,047	45
3	Ontario Champion,	34	475	1,141	15	22	880	748	
4	Mammoth White Intermediate	29	1,070	948	30	23	1,520	792	
5	White Belgian	28	265	937	45	28	1,420	957	
6	Half-Long Chantenay	26	140	869		27	120	902	

EXPERIMENTS WITH SUGAR BEETS.

Three varieties of sugar beets were grown on sandy loam in 1909. Two sowings of each variety were made, the first on May 8 and the second on May 22, in drills two feet apart, the plants being thinned out to about 6 or 8 inches apart in the row. All were pulled October 29.

The seed germinated very slowly, and the stand was uneven. The yield per acre was calculated from the product of two rows, each 66 feet long.

Specimens of the roots were sent to the Chemist of the Experimental Farms, Mr. Shutt, for analysis of sugar-content. The result is included in the following table:—

SUGAR BEETS—Test of Varieties.

Number.	Name of Variety.	Yield per Acre. 1st Plot.				Yield per Acre. 2nd Plot.				Sugar in Juice.	Solids in Juice.	Co-efficient of Purity.
		Tons.	Lbs.	Bush.	Lbs.	Tons.	Lbs.	Bush.	Lbs.	p.c.	p.c.	
1	Vilmorin's Improved..	15	525	508	45	14	1,700	495	..	18·28	19·63	93·1
2	Klein Wanzleben	15	360	506		15	20	500	20	17·80	19·43	91·6
3	French Very Rich	10	1,780	363	9	9	480	308	..	18·83	28·89	90·1

EXPERIMENTS WITH POTATOES.

Eighteen varieties of potatoes were planted on May 3 on sandy loam in the variety test. The land had been in Indian corn the previous year and in clover in 1907.

The seed was cut to two strong eyes per set and planted in drills 30 inches apart, the sets being about one foot apart in the drills. Owing to the dryness of the ground, the seed germinated very unevenly, and continued drought resulted in an uneven stand and poor growth.

All varieties were dug October 12 and 13. The yield, while low, owing to the unfavourable season, was good in quality and even in size. There was no rot in any of the plots. The yield per acre was estimated from the product of two rows, each 66 feet long.

POTATOES—Test of Varieties.

Number.	Name of Variety.	Total Yield per Acre.		Yield per Acre of Marketable.		Yield per Acre of Unmarketable		Form and Colour.
		Bush.	lbs.	Bush.	lbs.	Bush.	lbs.	
1	State of Maine....................	367	24	252		125	24	Round white.
2	Dalmeny Beauty................	356	24	241	00	105	24	Oblong white.
3	Holborn Abundance	356	..	303		52		Round white.
4	Gold Coin.........................	343	12	259	12	84		Oval white.
5	Carman No. 1..................	310	12	239		81	12	Round white.
6	American Wonder......	290	24	200		90	24	Long round white.
7	Rochester Rose.....	288	12	228		60	12	Long rose.
3	Money Maker	283	48	243		40	48	Long white.
9	Dreer's Standard.........	268	24	214	24	54		Round white.
10	Irish Cobbler.............. ...	257	12	181		76	12	" "
11	Dooley..	250	48	214	12	36	36	" "
12	Morgan Seedling..................	211	12	157	12	54		Long pink.
13	Everett.....	200	12	125	12	75		Long reddish.
14	Late Puritan	196	20	147		49	20	Long white.
15	Empire State......................	187	..	142		45		" "
16	Ashleaf Kidney.........	184	48	129	48	55		Oblong "
17	Reeves' Rose................	182	..	131		51		" rose.
18	Uncle Gideon's Quick Lunch	151	48	129	48	32		Round pale pink.

FODDER PLANTS.

Owing to pressure of other work, the plots of fodder plants were not sown until May 18 and, as the ground was getting dry by that time, the seed germinated slowly and the drought continuing the growth was feeble and the yield was very light. These plots were sown on a clover stubble turned under which had been well prepared with disc and drag and was in good condition.

Plot 1. White Round French Millet.—Stalks 12 to 16 inches long, with very few leaves and short heads. Weight of crop, dried, taken from one-twentieth of an acre, 108 lbs.; at the rate of 1 ton 160 lbs. per acre.

Plot 2. Italian Millet.—Stalks 16 to 18 inches long, weight of cured crop, 123 lbs.; at the rate of 1 ton 460 lbs. per acre.

Plot 3. German Millet.—Stalks 16 to 20 inches long, not leafy and heads from 1½ to 3 inches long. Weight of cured crop, 102 lbs., or 1 ton 40 lbs. per acre.

Plot 4. Pearl Millet.—Stalks 14 to 20 inches long, heads short and poor. Weight of cured crop, 107 lbs.; 1 ton 140 lbs. per acre.

Plot 5. Horse Beans.—Sown in drills 21 inches apart. Cut October 12. The seed germinated very unevenly and the stand was uneven and poor. Length of stalks 9 to 15 inches, and very few pods, which were very short and immature. Weight of crop, 197 lbs.; 3 tons 1,880 lbs. per acre.

Plot 6. Horse Beans.—Sown in drills 28 inches apart. A very uneven stand and crop light. Weight of crop, 119 lbs.; 2 tons 760 lbs. per acre.

SUMMARY OF CROPS.

Hay.—Owing to the very unfavourable winter, during which heavy rains were followed by sharp frosts, a great deal of injury was sustained by the meadows.

The clover especially was seriously damaged, much of it being heaved out. Then the cold, drying winds of March and April prevented growth and, as a consequence, the hay crop was lighter than for years past. As the dry weather continued after the first crop was harvested, the second growth was also poor.

HAY.

	Tons.	Lbs.	Tons.	Lbs.
First crop	26	1,600		
Second crop	10	1,200		
Total	—	——	37	800
Corn in silo			96	...
Mixed grains cut for hay			5	480

ROOTS.

	Tons.	Lbs.		
Mangels	9	650		
Turnips	41	1,200		
Carrots	8	630		
Total	—	——	59	480

GRAIN.

	Bush.	Lbs.	Tons.	Lbs.
Spring wheat	32	18	..	1,938
Mixed oats and wheat	..	..	1	980
Oats	174	12	2	1,928
Barley	22	44	..	1,100
Peas	110	..	3	1,600
Mixed oats and peas	...	..	16	472
Total			26	18

GARDEN VEGETABLES.

The cold, dry weather of the spring prevented a free germination of the seeds of the more tender varieties of garden vegetables and flowers, and a poor stand in many instances followed. As a result of continued unfavourable weather, the quality of most varieties of table vegetables was not very good.

Table Beets.

Two varieties of table beets were sown, the Extra Early Egyptian Blood Turnip and Nutting's Dwarf Improved. The Early Egyptian reached two inches in diameter by July 14, and the Nutting's Improved the same size by the last of the month. Both are of first rate flavour and quality, when grown under favourable conditions.

Table Turnips—Sown April 7.

Extra Early White Milan was the only table turnip sown this year. This variety is very early, of superior quality for table, and if sown in succession, may be had in first-class condition throughout the season. It grows very rapidly and a small plot sown near the stable furnishes a very acceptable addition to the fare of working horses or of any animal which is on dry feed.

Radish.

Sown April 7, and in succession during the spring and early summer.

Early Scarlet White Tipped.—A smooth root, white and crisp. Fit for table May 15.

Early Scarlet Turnip.—Crisp and sweet. Fit for table May 13.

Olive Scarlet.—Fit for table May 20. A smooth, handsome root, and of very good quality.

Early White Turnip-rooted.—Fit for table May 22. A rapid grower, rather strong and stringy.

French Breakfast.—Sweet, crisp and fine flavoured. Fit for table May 28.

Lettuce—Sown April 8.

Iceberg.—A rapid grower and very fine and crisp in quality. Fit for table May 28.

Simpson's Early Curled.—A fine large-leaved lettuce of very good quality, crisp and juicy. Fit for table May 30.

Hydrangea Pariculata Grandiflora, Agassiz, B.C.

16—p. 504

All the Year Round.—A strong grower, not crisp and a little bitter. Fit for table June 4.

Wheeler's Tom Thumb.—A vigorous grower, of only fair quality. Fit for table June 8.

GARDEN PEAS—Sown April 7 and 8.

Rennie's Extra Early.—Fit for table June 14. Vines 20 to 24 inches long and fairly productive. Pods of medium length and well filled; peas of medium size and of good flavour.

American Wonder.—Fit for table June 18. Vines very dwarf, fairly productive, pods short, peas of good size and of very fine flavour.

Thomas Laxton.—Vines 2½ to 3 feet high and productive; pods long and very well filled; peas large and of very superior flavour. Fit for table June 20.

Horsford's Market Garden.—Vines 3 to 3½ feet long, productive, pods of medium length, well filled, peas medium large and of very superior flavour. First peas fit for table July 10.

Dwarf Telephone.—Fit for table June 20. Vines 16 to 18 inches long and productive. Pods very long and well filled with large peas of very fine flavour and quality.

Rennie's Queen.—Vines 3 feet long and very productive. Pods loug and well filled with large, very sweet and delicious peas. Fit for table July 12.

BEANS—Planted April 8.

Extra Early Valentine.—Very productive. Fit for table July 9. Pods of medium length, round, thick, and solid, crisp, tender, of very pleasant flavour.

Six Weeks.—A very strong grower and productive. Pods long, flat, crisp, of fair quality. Very short in season. Fit for table July 11.

Dwarf Emperor of Russia.—Vine a fair grower and fairly productive; pods 2 to 4 inches long; fit for table July 19.

Longfellow.—A vigorous grower and productive. Pods 4 to 6 inches long, straight, round and solid; crisp and of fine quality; fit for table July 19.

Improved Prolific Black Wax.—Vines are strong growers and prolific. Pods 3 to 5 inches long, plump, round, crisp and solid. Fit for table July 21. Of very mild pleasant flavour.

Improved Golden Wax.—Fit for table July 21. Pods long and flat, stringless, and of very fine flavour, remaining fit for use for a long time.

CABBAGE.

The cabbage seed was sown in the open garden in beds, on April 3. The seed did not germinate well and the plants did not make a strong growth. They were transplanted May 25 and 26.

Paris Market.—Fit for table July 23. Heads small, solid, crisp and white; of very good flavour and an even header.

Early Jersey Wakefield.—Fit for table July 27. Heads, solid and crisp; one of the best of the very early varieties.

Sutton's Earliest.—Fit for table July 27. An even, regular header; heads solid, white and of very good quality.

Early Midsummer.—Fit for table August 17. This variety produces only a small per cent of solid heads, the remainder being loose and open; of only fair quality.

Early Winningstadt.—Fit for table early in September. Heads of fair size, pointed, solid, white, and of very good flavour. One of the best second early varieties.

Long Island.—Fit for table early in September. A medium-sized round head; of very good quality. Heads solid, crisp, white and of very fine flavour.

Netted Savoy.—A medium early-heading variety of superior merit. A regular header; heads of medium size; very solid, crisp and white. Fit for table in September.

Savoy Drumhead.—Fit for table late in September, and an excellent keeper. Heads broad, flat, solid and crisp; white, tender and of excellent quality.

Extra Blood Red Dutch.—A very regular, even header, heads medium in size, solid, very deep red, crisp, of fine quality, and a good winter keeper.

Danish Ball Head.—An excellent header. Of medium size, round, very hard, white and crisp; an excellent winter keeper.

Surehead.—A fine regular header, solid and of fair size; crisp and a good winter keeper.

CARROTS—Sown April 5.

Early Scarlet Horn.—Short, stump-rooted, grows very rapidly and is full flavoured and sweet when still very small. Fit for table June 11.

Half Long Scarlet Nantes (Improved).—A rapid grower and a fine, smooth, crisp root. Fit for table early in July.

Chantenay.—A rapid grower, and of very good quality as well as a fine cropper. Fit for table early in July.

Half-Long Scarlet Luc.—Fit for table early in July; a fine cropper; crisp and sweet.

CAULIFLOWER.

Sown in a seed bed in the open garden April 3, and the plants set out May 25 and 26. The plants were small as the growth had been very feeble in the beds.

Selected Early Erfurt White.—Fit for table late in July; heads small but very white and sweet.

Early Snowball.—Fit for table early in August. Heads medium large, firm and crisp, white and of fine quality.

Walcheren.—Heads large, white, solid, sweet and of good quality. Fit for table early in September.

BRUSSELS SPROUTS.

Sown in seed bed April 3 and transplanted the last of May.

Sutton's Matchless Dwarf Improved.—Stalks medium short but very closely set with large sprouts of very delicate flavour. A good keeping variety.

Improved Half Dwarf.—A strong growing variety and very well furnished with solid sprouts of excellent quality. Fit for table early in September, and an excellent winter variety.

New Giant.—A strong, tall-growing variety, thickly set with solid sprouts of good size, and of very mild, pleasant flavour. A good winter sort.

Brocoli.

Seed sown in open beds April 3 and transplanted the last of May.

Superb Early White.—Fit for the table by the last of August. Heads of fine size solid, very white and crisp, sweet and of delicate flavour.

Extra Early White.—Fit for table late in August. Heads of medium size, crisp, firm, white; a good quality, remaining so for a long time.

Sutton's Main Crop.—Fit for table in September. Heads large, white and of good flavour, keeping fit for use for a long time.

Table Corn.

Planted in hills three feet apart each way, four stalks being left in each hill of the small growing sorts and three stalks of the taller growing varieties.

Golden Bantam.—Planted May 12 and fit for table July 28. Stalks 3 to 4 feet in height and producing three to four ears each; ears 4 to 6 inches long and filled out to the end with deep kernels of the finest flavour.

Premo.—Planted May 12. Fit for table August 4. Stalks 4 to 6 feet in height and frequently producing two ears each. Ears 5 to 7 inches long and filled to the tip; corn very sweet and tender.

Early Fordhook.—Stalks 5 to 7 feet in height and often producing two large well-filled ears per stalk. A superior corn, very sweet and tender. Fit for table August 6, remaining so for a long time.

Seymour's Sweet Orange.—Fit for table by the middle of August. Stalks 6 to 7 feet in height; often two fine ears, 5 to 8 inches long on a stalk; corn very sweet and of good flavour.

Ringleader.—Fit for table by the middle of August. Stalks strong and from 6 to 7 feet high. Ears large and well filled with deep grains of very fine quality.

Malakoff.—Fit for table in August. Stalks 5 to 6 feet in height, producing large, well-filled ears of very sweet, delicious corn, which remains in good table condition until late in September.

Early White Cory.—Fit for table in August. Stalks 3 to 4½ feet high, often producing two fine, well-filled ears of sweet, delicious corn.

Onions—Sown March 25.

Sown in drills 18 inches apart. As the spring was so cold and dry, the drought continuing during the early summer, the onions did not develop well and were later in maturing and smaller than usual.

Large Red Wethersfield.—Below medium size, solid and mild flavoured.

Trebon's Large Yellow.—Onions fairly large, but many go to necks and do not ripen.

Extra Early Red.—Onions small but ripen early, forming solid bulbs of mild, sweet flavour.

Southport White Globe.—Bulbs of medium size and solid, ripening well and producing a large proportion of well-ripened onions, of mild, sweet flavour.

Large Yellow Globe Danvers.—Bulbs of medium size, very solid and very few unripe; mild, sweet and good in quality.

Australian Brown.—Bulbs of small, medium size, firm, solid and good, ripening early, with a large per cent of well-formed bulbs. A very good sort.

PUMPKINS—Planted May 10.

The following varieties were planted in hills ten feet apart each way and three strong plants were left in each hill.

Large Field.—Vines very strong growers and productive of deep-fleshed and large pumpkins.

Mammoth Tours.—Vines very long, pumpkins very large, rather coarse in flesh but thick-meated and heavy.

Jumbo.—Vines long and pumpkins large. Too coarse for table use but good for stock.

Quaker Pie.—Vines long and quite productive. Fruit of medium size but very heavy; thick-fleshed, fine-grained and of good quality.

Sweet or Sugar.—Vines long and very productive. Fruit small, thick-fleshed, sweet and very fine in quality.

Large Cheese.—Vines vigorous and very productive; very rapid growers. Pumpkins large, handsome, orange skin, with thick, yellowish flesh of fine quality.

SQUASH.

Planted in hills May 11. Thinned to three strong plants in a hill.

White Bush Scalloped.—Hills 6 feet apart. Very productive and of very fine flavour. Fit for table August 17.

Giant Summer Crookneck.—A strong bushy grower and very productive. Fruit large, crookneck, very solid and of very fine quality. Fit for table August 20.

English Vegetable Marrow.—Planted in hills 12 feet apart and plants thinned to three strong plants in a hill. Vines vigorous and productive; fruit 8 to 14 inches long, seven to nine inches in diameter. Flesh thick, fine-grained, of very fine flavour. Fit for table by the last of August.

Orange Custard Marrow.—Vines strong growers and quite productive. Fruit 6 to 14 inches long and 6 to 8 inches in diameter. Skin bright orange; flesh golden yellow, thick, fine-grained and of fine quality. Fit for table early in September and keeps until the beginning of winter.

Mammoth Whale.—Vines very strong growers and productive; squash, large, dark grayish-green in colour; flesh thick, yellowish, a little coarse, of only fair quality for table, but good for feeding to stock.

Delicata.—Vines strong growers and very productive. Fruit small, weighing from 5 to 13 lbs.; skin, orange striped with green; flesh, orange, very thick, fine-grained and sweet; a very superior table squash. Fit for table in October and is a good winter keeper.

Delicious.—Vines strong growers and productive. Skin, green; flesh orange, thick, sweet, fine-grained and with very fine table qualities. A good winter variety.

Hubbard.—Vines vigorous and productive, of very fine quality for the table and one of the best for winter

Celery.

Seed of three varieties of celery was sown in a small hot-bed on April 8 and transplanted on June 22. The soil was very dry when the plants were set out and continued so until autumn, hence the growth was slow and the quality of the celery was not up to the standard.

White Plume.—A medium grower and of very fine, crisp, sweet flavour. A good autumn variety.

Rose-ribbed.—A medium vigorous grower; stalks solid, crisp, pleasant in flavour; a very good autumn and early winter sort.

Giant Pascal.—A very strong grower; stalks long, thick, and very crisp. Flavour mild and pleasant. A good winter variety.

APPLES.

The winter of 1908-9 was the severest for fruit trees that we have had for many years. The summer of 1908 had been rather dry and hot during July and August and growth in the fruit trees was at a standstill until September, when we had copious rains. This caused the fruit trees to put on fresh growth, with the result that when the cold weather set in they were still in a growing condition with a great deal of unripened wood and leaves green and full of sap.

The sharp frosts and severe, long-continued winds of winter were very injurious to the trees and many were so enfeebled that they died when spring opened. The rain in the second week in January froze on the twigs and branches until they were covered with a heavy coat of ice and the north wind which followed broke and split many more trees. Those which survived were, in many instances, too feeble to bring their fruit to maturity, and in consequence the crop was very light and below the average in quality.

Commercial Apple Orchard.

Several trees of some varieties in this orchard died this summer from the effects of the ice and freezing. Of the varieties which fruited in 1908, only Grimes' Golden and King bore fruit this season. Each of these varieties bore a few apples and made a fair growth, but they were the only kinds to come through the severe winter without loss.

The following have been added to the commercial orchard this spring: Belle de Boskoop, Delicious and Rome Beauty.

Orchard No. 4.

All the trees in this orchard made a satisfactory growth this year, and several promising new varieties have been propagated and will be added to it from time to time as they develop. There are thirty-five varieties planted in this orchard now.

PEARS.

The pear trees suffered from the severe weather at the same time as the apple trees, and those varieties which fruited last summer were unable to perfect the fruit sufficiently to bring it up to the standard of former years. Quite a number of trees leaved out in spring but the leaves fell off in the summer and the trees died. Many others made a feeble growth.

Commercial Pear Orchard.

The plum crop was a light one and the fruit not first-class in any variety. Quite a number of trees were split or broken down by the winter storms and were taken out.

Several others blossomed, set fruit and gave promise of a crop, but in early summer the leaves began to fall off and the fruit dried up before it was full grown. Several of these trees died and have since been taken out.

PLUMS.

Most of the trees in this orchard have made a satisfactory growth, but a few have died from the effects of the previous winter. A few varieties have been sufficiently tested in the experimental orchards to be added to the commercial orchard this spring.

Commercial Plum Orchard.

The plum trees have made a satisfactory growth and a few of them give promise of fruiting this summer.

CHERRIES.

Like the other fruits, the cherry trees were not very productive this season, very few trees having any fruit. The Morello cherry trees were the only ones which fruited.

PEACHES, APRICOTS, NECTARINES.

None of the trees left of these fruits, either on the level land or on the mountain, fruited this year.

MEDLARS.

This fruit appears to do about as well one year as another. It does not bloom until late in May, and is safe from very cold rains or frosts and, as a rule, produces a good crop every year.

MULBERRIES.

Several of the mulberry trees were split and destroyed by the ice and were taken out. The trees remaining had very little fruit, and what there was did not grow to full size or ripen.

PERSIMMONS.

The persimmon trees lived through the trying winter but did not fruit this season.

MOUNTAIN ORCHARDS.

Although the orchards on the mountain have been neglected for some time owing to scarcity of labour, and have been injured by bears climbing and breaking them down to get the fruit, yet the crop of apples and plums was heavier there than on trees of the same age and variety growing on the level bottom land, and the fruit is generally freer from blemishes.

As in previous years, the bears commenced harvesting the plums before they were quite ripe, and continued to look after the fruit until the last of the apples were picked. Owing to the bears' ability as a climber, it is practically impossible to protect small orchards like this, which are surrounded with large areas of timber.

The timber and nut trees planted some years ago on the mountain have grown, and especially where the undergrowth of ferns and native shrubs is at all thin, they have made a fair growth and are becoming recognizable from the valley when the leaves turn in the autumn and, as they rise above the ferns, they will grow faster.

SMALL FRUITS.

The storm of January, 1909, proved very destructive to all small fruits. Blackberry and raspberry canes were broken down to the ground and many were severely injured in their roots. Of the blackberries, the Eldorado alone withstood the cold and ice to some extent and bore a little fruit. There were no raspberries.

The red, white and black currant bushes, although bent with the weight of the ice, were not broken but were considerably injured, although they fruited freely. The fruit, however, was small and of poor quality. Some of the bushes died when the fruit was half grown.

NUT PLANTATION.

Last winter was so severe, following, as it did, an unfavourable summer, that the nut trees did not leaf out till late in the season, the English walnuts not being in leaf till late in May and the chestnuts not until July. None of these had any nuts on last fall, and the black walnuts and the butternuts fruited very sparingly. The Japanese walnuts fruited very well. The shell-bark hickory also fruited but, the trees on this Farm being seedlings, the nuts are very small.

The Japanese walnuts are being more appreciated as the seedling trees from the earlier distribution grow larger and develop. They make a very handsome shade tree and will be useful where a windbreak is needed to protect fruit orchards from autumn winds.

None of the pecan trees have fruited yet. Several of them were killed last winter, and it is doubtful if this tree is of any value in this district.

The crop of filberts was very light, except on Pearson's Early Red. This variety had a fair crop, but it is impossible to protect them from the blue jays, which come from the woods in large numbers and commeuce to carry off the clusters of nuts long before they are mature.

FOREST PLANTATION.

The eastern forest trees planted in the spring of 1893 have, almost without exception, made a strong, healthy growth. Such varieties as the hickory, walnut, oak, white pine, maple, beech and basswood, have in many instances attained a height of over 30 feet, with a diameter of from 6 to 10 inches at stump height.

HORSES.

The force of horses on the Farm remains the same as at the time of my last annual report, namely, three span of working horses, one of the old horses brought here in 1889, and a young general purpose mare, used as a driver. There has been no accident or sickness among the horses during the past year.

CATTLE.

Since my last report, several bulls have been sold for breeding purposes and a number of the older cows have been fattened and sold to the butcher. We have on hand one very fine bull, got as a calf from the Central Experimental Farm, and two young bulls, eleven cows and heifers of breeding age, and six very fine heifer calves, making a herd of twenty pure-bred Shorthorns. There has been a slackening off in the demand for Shorthorns in this lower country, and several herds have been dispersed in the last three years owing to the increased interest taken in dairying, and bulls of the dairy class have been used instead of those of the beef breeds.

SHEEP.

All of the sheep on the Experimental Farm are pure-bred Dorset Horned, and they seem to be very well adapted to this damp climate. The ewes are excellent

mothers, giving a plentiful supply of milk for their lambs and they are prolific, oftener producing twins than single lambs. The flock consists of seventeen ewes and a ram and nine lambs up to date, one fat ewe and two rams having been sold, and one ewe and three lambs killed last spring by wild animals.

PIGS.

The stock of pigs at present consists of one Berkshire sow and one boar, and of Yorkshires, one boar, three breeding sows and fifteen young pigs of both sexes. Since my last report, twenty pigs have been sold, most of them for breeders, and there is considerable demand at present for young breeding stock, both boars and sows.

POULTRY.

During the past year, the same varieties of fowls have been kept as in the year previous, and with practically the same results.

The fowls have been healthy, except that occasionally one would go lame, as if from rheumatism. Our practice is to kill immediately any ailing fowl, as it is unwise to breed from one which has at any time been ill.

The breeds kept are: Rhode Island Red, Black Minorca, Barred Plymouth Rock, Buff Orpington and White Wyandotte. Of these the Rhode Island Red laid the largest number of eggs during the year with the Black Minorcas a close second. The Buff Orpingtons, Barred Plymouth Rocks and the White Wyandottes are about equal as layers with us. The Rhode Island Reds and White Wyandottes mature the earliest, although they are not as large when mature as are the Buff Orpingtons and Barred Plymouth Rocks.

Each breed is kept in a separate pen from January 1 to July 1. After that they are all at large. While they are in pens, the hens of one pen, each breed in its turn, are at large, giving them their liberty one day in five, when their having so large a range and eating grass and insects of various kinds will be likely to insure a better hatch and stronger chickens.

The fowls are fed mixed grain, wheat, peas, oats and barley; about one-half wheat, one-quarter oats and one-quarter peas or barley.

The little chickens are raised in coops of about $2\frac{1}{2}$ x 3 feet in size, which are placed on board platforms. Once a week, these coops are lifted off the platforms, which are cleaned, fresh chaff or dry earth placed on them and the coops replaced. One advantage in having the board floor is that skunks cannot burrow in under the coop and get to the chickens as they might if the coop were placed on the ground, and besides it is dry, which is an important consideration in this climate. There is a slatted door which is used in the daytime for the first two or three weeks to keep the hen in and let the chickens run in and out and a solid door which is always used at night.

The little chickens are fed, when twenty-four hours' old, bread crumbs mixed with hard-boiled egg. On the third or fourth day there is added to this pin-head oatmeal. Fresh water and grit are always before them. Once or twice a week, they get a little cooked or raw meat cut fine, or sometimes, in place of the meat, they get any kind of good, clean grease or drippings, mixed with the pin-head oatmeal. When the chickens are about three weeks old, we begin to feed some whole wheat and a little cracked corn as well as the pin-head oatmeal, and, on dry days, the hen and her chickens are allowed their liberty, when they can pick up a variety of food themselves.

In winter, all the fowls have a cabbage head or turnip to pick, and besides the small potatoes are boiled and mashed with a little chop of whatever kind we have.

The pens are cleaned once a week, when fresh chaff, three or four inches deep, is put on the floor. The whole of the inside of the building is cleaned several times in the year by spraying with whitewash to which is added a little carbolic acid. The

roosts are frequently washed with sheep dip, keeping the house and fowls almost free from insects.

The yards are frequently limed and dug over. This practice, together with being empty from July to January keeps the yards clean and pure. It is necessary to pay particular attention to this in this climate as we have considerable damp weather, which we find much more trying to the fowls than bright, frosty weather.

There has been a good demand for eggs for hatching and also for any spare birds, both male and female.

BEES.

Last season was too dry, and, as a consequence, nectar was scanty in the flowers, the bees storing but little honey.

There were eleven swarms in the spring and at this date there are nineteen which appear to be fairly strong and are actively at work on fine days.

CLEARING.

About four acres of light clearing has been underbrushed and grubbed, ready to plough, and about two acres ploughed twice and will be cropped this summer. No more ditching has been done, as it was impossible to get sufficient labour to carry on the work of the Farm and keep everything in good conditiou as one would like to have it. As a result, the mountain orchards have been neglected as the work on the level portion of the Farm was of much more importance.

SAMPLES DISTRIBUTED.

There is very little call in this district for samples of seed barley, field peas or wheat: most of the demand being for oats and potatoes. Following are the samples sent out:—

Spring whea	17
Seed oats	241
Seed barley	29
Seed peas	47
Seed potatoes (bags, 3 lbs.)	290
	624

There was no Indian corn, fall wheat or rye for distribution this year.

CORRESPONDENCE.

Letters received	4,751
Letters despatched	4,506

METEOROLOGICAL RECORD.

Month.	Highest Temperature.		Lowest Temperature.		Total Precipitation.	Bright Sunshine.	
1909.	Day.	Deg.	Day.	Deg.	Inches.	Hours.	Min.
April	30	71	22	29	4·22	158	30
May	2	78	21	30	2·32	168	18
June	13	86	4	38	2·36	200	18
July	12	87	18	41	3·49	206	36
August	19	87	9 & 21	42	3·18	199	24
September	8	88	17	37	6·35	123	18
October	12	68	26	29	5·49	88	24
November	4	61	15	25	20·88	43	42
December	16	47	3	14	2·10	73	54
1910.							
January	31	58	3	22	4·58	44	48
February	16	53	21 & 22	10	5·41	69	00
March	18	72	23	28	5·36	108	36
Total Precipitation.	.....	....	....	.....	65·84	1,484	48

Total precipitation for year ending March 31, 1909, 44·02 inches.
Total precipitation for year ending March 31, 1908, 55·40 inches.
Total sunshine for 1909, January 1 to December 31, 1,457 hrs. 48 min.

I have the honour to be, sir,

Your obedient servant,

THOS. A. SHARPE,

Superintendent.

INDEX